



# I-190/Silver Street Study

Phase I Study Report  
December, 2010

HDR



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# I-190/Silver Street Study Phase 1 Study Report December, 2010

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## Chapter 1 – Introduction

The South Dakota Department of Transportation (SDDOT) has requested a multi-phase study to evaluate the design, operations, policy and funding implications of replacing the Silver Street interchange on I-190 in Rapid City. The study has been spurred by structural deficiencies with the Silver Street Interchange bridges and may include options to redesignate I-190 from the Interstate system to an expressway or arterial street, designated as US 16.

This first phase of the study develops interchange and intersection alternatives to replace the existing interchange, coordinates the alternatives with SDDOT and the City of Rapid City, measures public opinion regarding potential changes, estimates the implications on federal funding, recommends a path for regulatory approval (if needed), and forecasts the impacts on transportation operations and the environment. A subsequent phase of the study may analyze options in more detail and fulfill the Federal requirements for analysis contained in an Interstate Justification Report (IJR) and an Environmental Assessment (EA).

Interstate 190 is a spur route on the Interstate Highway System, connecting Interstate 90 with Omaha Street in the central business district of Rapid City, SD. It was originally constructed to fulfill part of the Interstate's original mission of connecting major cities. At the time that the route for Interstate 90 was being selected, Rapid City did not extend as far north as it currently does.

Consequently, the I-190 link was built to provide the desired Interstate link between Rapid City and the rest of the Interstate

system. Rapid City has now grown to encompass roughly six miles of Interstate 90 and is served by six I-90 interchanges.



Silver Street interchange area, showing life-limited structures and low overhead clearance.

There is only one interchange on Interstate 190, the Silver St./North St. interchange. It is configured as a non-traditional diamond interchange, with the south ramps having minimal separation from the I-190 mainline. An all-way stop intersection serves the northbound off-ramp, the east portion of West Boulevard (which serves as an I-190 frontage road), North Street and Silver Street. The southbound on-ramp is also served by a channelized movement from the all-way stop intersection. The southbound off-ramp intersects with Silver Street west of the all-way stop intersection. The northbound on-ramp intersects with West Boulevard, north of Anamosa Street.

The existing interchange has deficiencies related to its non-standard configuration and limited overhead clearance. Likewise, I-190 has deficiencies related to terminating an Interstate Highway at an at-grade signalized intersection. While they were acceptable designs 50 years ago, the existing Interstate termination and interchange configuration would likely not be allowed to be added to the Interstate system today.

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The subsequent chapters of this report are related to work tasks identified in the scope of work for this study. Each chapter is introduced with general remarks about the work task.

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## Chapter 2 – Baseline Analysis

An analysis of the existing conditions was necessary to determine any present-day transportation system deficiencies. Conditions for the future year (2030), without any transportation system improvements, were also estimated. This baseline analysis allowed the identification of needed system improvements.

**Subtask 101 – determine extent of study area.** HDR prepared a graphic showing the proposed study area and presented the concept to the Study Team at the kick-off meeting in Rapid City on March 22. The Study Team had no comments and the study area was determined to include the portions of the Interstate and arterial street systems as shown in Figure 2-1.

The study area includes the following roadways:

- Interstate 190 (entire length)
- Interstate 90, west of I-190 to east of Haines Avenue
- West Boulevard, south of Omaha Street to south of I-90
- Omaha Street, west of West Boulevard to east of 5<sup>th</sup> Street
- Silver Street, west of Boegel Street to West Boulevard
- North Street, West Boulevard to east of Haines Avenue
- Mt. Rushmore Road, south of Omaha Street to North Street
- 5<sup>th</sup> Street, south of Omaha Street to North Street
- Haines Avenue, North Street to north of Disk Drive
- Anamosa Street, west of West Boulevard to east of Haines Avenue
- Disk Drive, Howard Street to east of Haines Avenue

Interstate interchanges include:

- I-90/I-190
- I-90/Haines Ave.
- I-190/Silver St. and adjacent ramps
- Adjacent I-90 interchange ramps necessary to analyze study area ramps operations

Arterial intersections include:

- Disk Dr./Haines Ave.
- I-90/Haines Ave.
- Anamosa St./Haines Ave.
- North St./Haines Ave.
- 5<sup>th</sup> St./Omaha St.
- Mt. Rushmore Rd./North St.
- Mt. Rushmore Rd./Omaha St.
- West Blvd. (W)/Anamosa St.
- West Blvd. (E)/Anamosa St.
- Boegel St./Silver St.
- I-190/Silver St./North St.
- West Blvd./Omaha St.



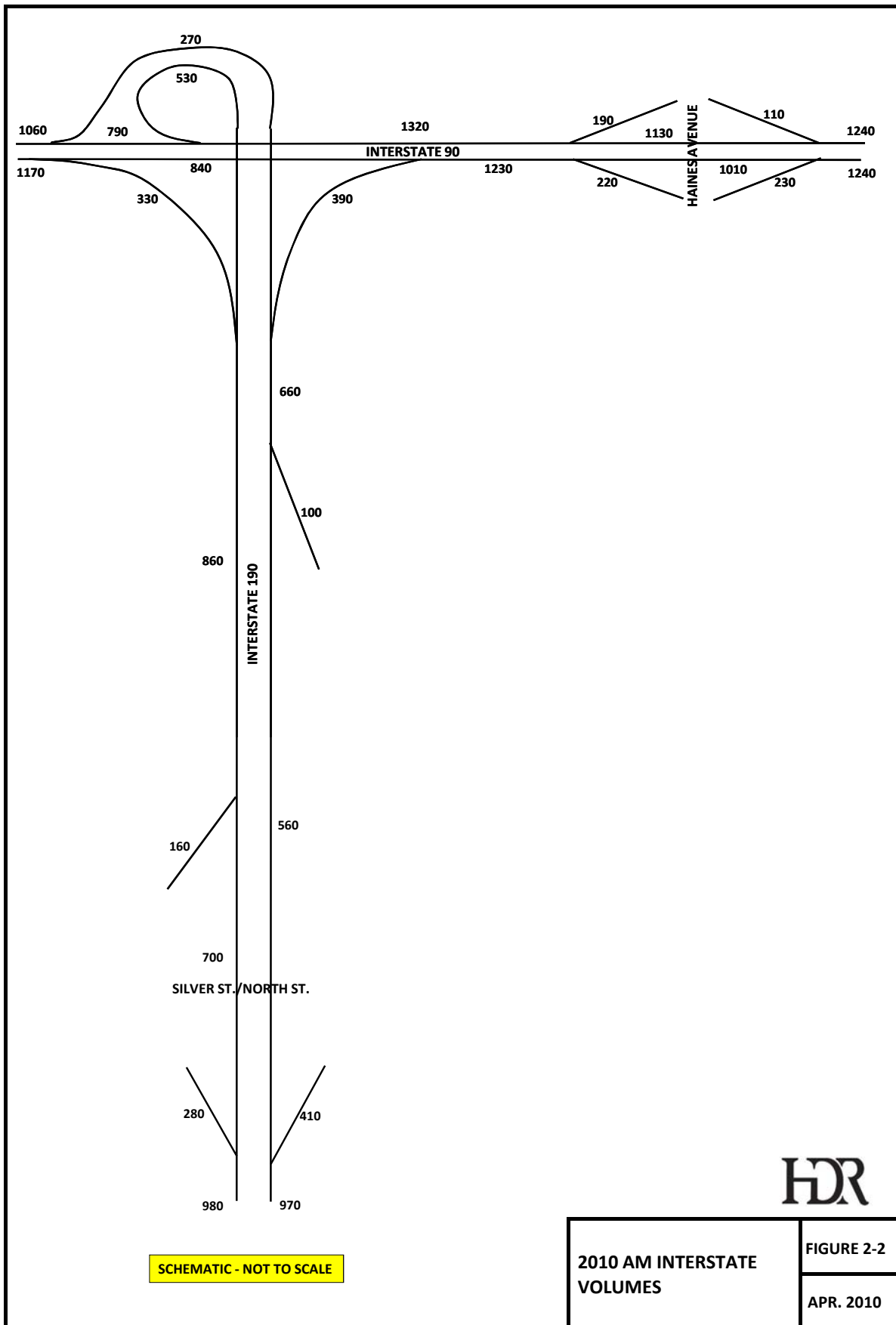


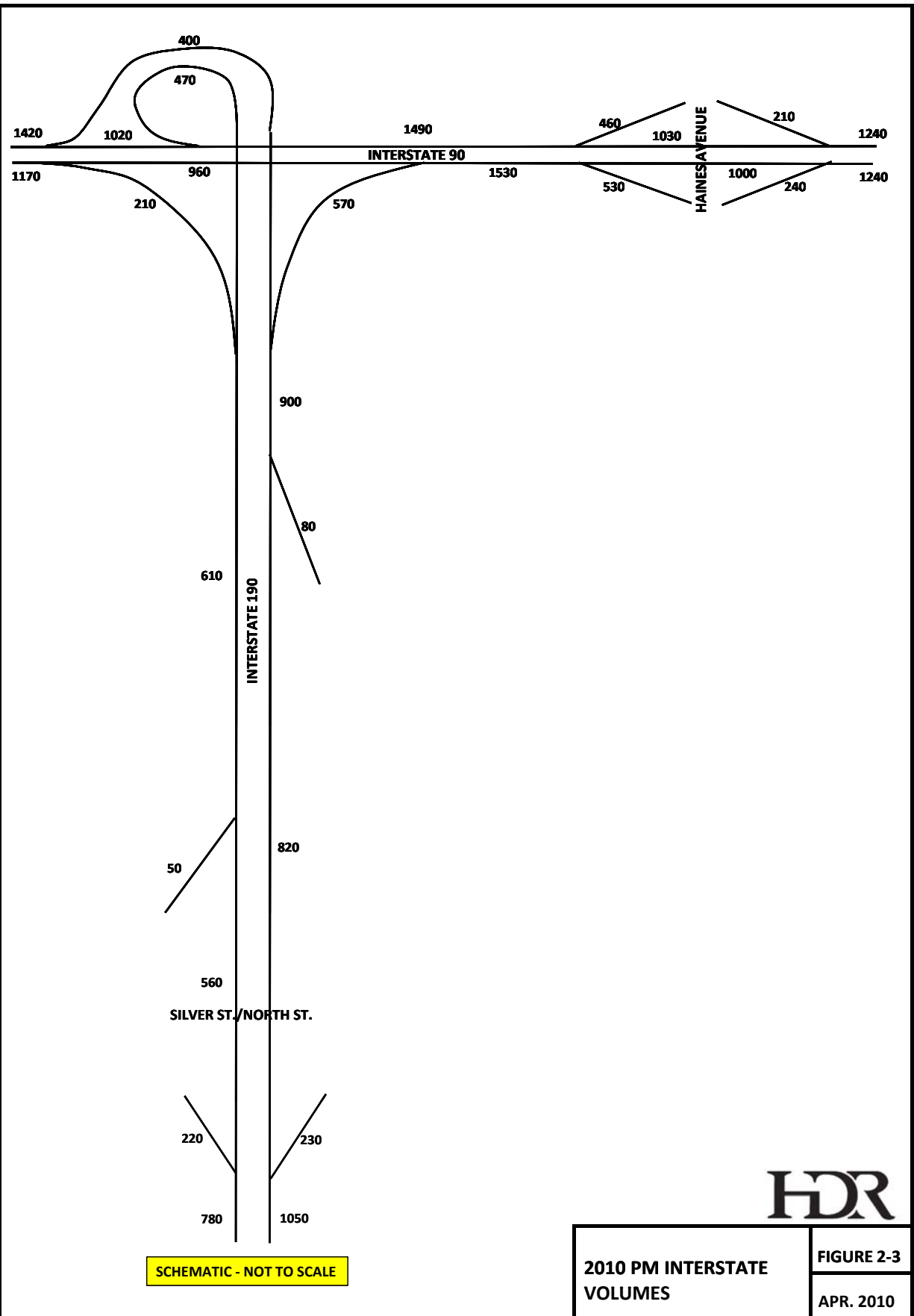
**Figure 2-1 – Study Area**

**Subtask 102 – Gather existing air-photo and GIS coverage.** Airphoto bases were received in March and were used for development of concepts and other work items. GIS coverage for crash analysis was received from SDDOT in April. Other GIS coverage, such as utilities, may be needed for preliminary design.

**Subtask 103 – Gather available traffic data from SDDOT and City.** Traffic data was obtained from SDDOT and the City and supplemented by turning movement counts performed by HDR staff. The peak hour Interstate counts are shown in Figures 2-2 and 2-3. The peak hour arterial intersection turning movements are shown in Figures 2-4 and 2-5.

**Subtask 104 – Produce peak hour movement forecasts.** Traffic forecasting information was obtained from the regional traffic forecasting model maintained by the City and used to produce peak hour movement forecasts. The peak hour Interstate forecasts are shown in Figures 2-6 and 2-7. The peak hour arterial intersection turning movements are shown in Figures 2-8 and 2-9.







2010 PM INTERSTATE VOLUMES	FIGURE 2-3
	APR. 2010



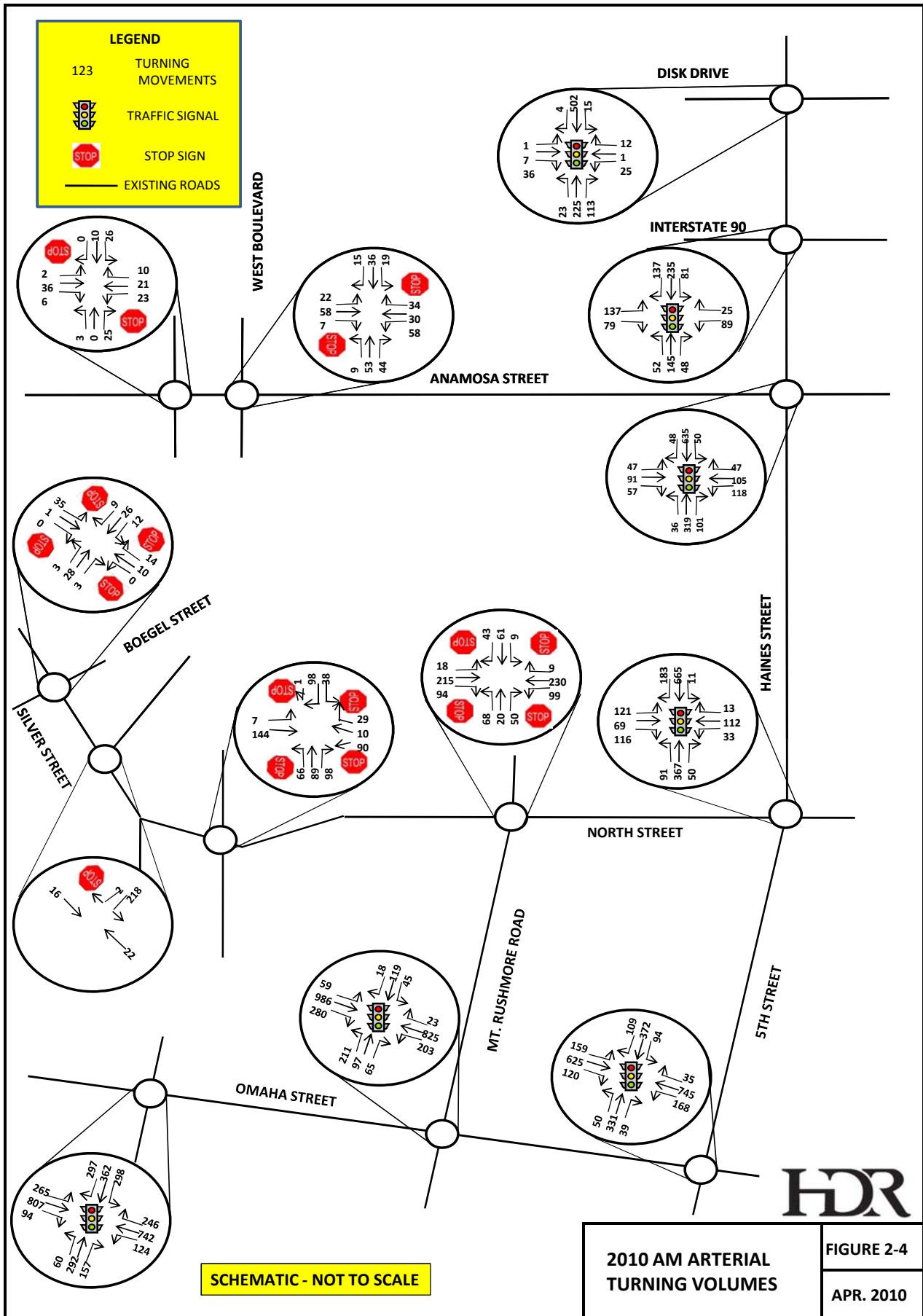
**LEGEND**

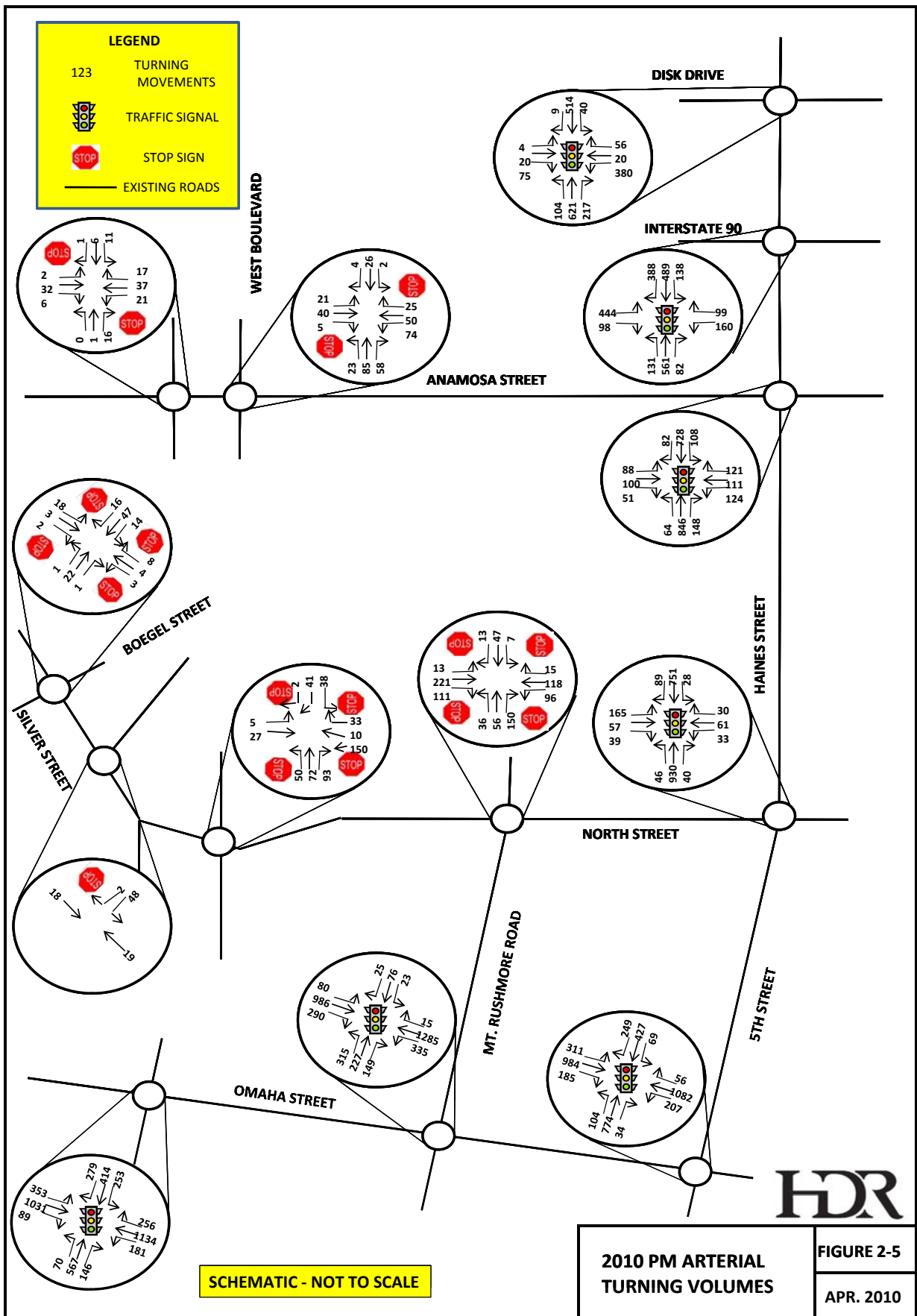
123      TURNING MOVEMENTS

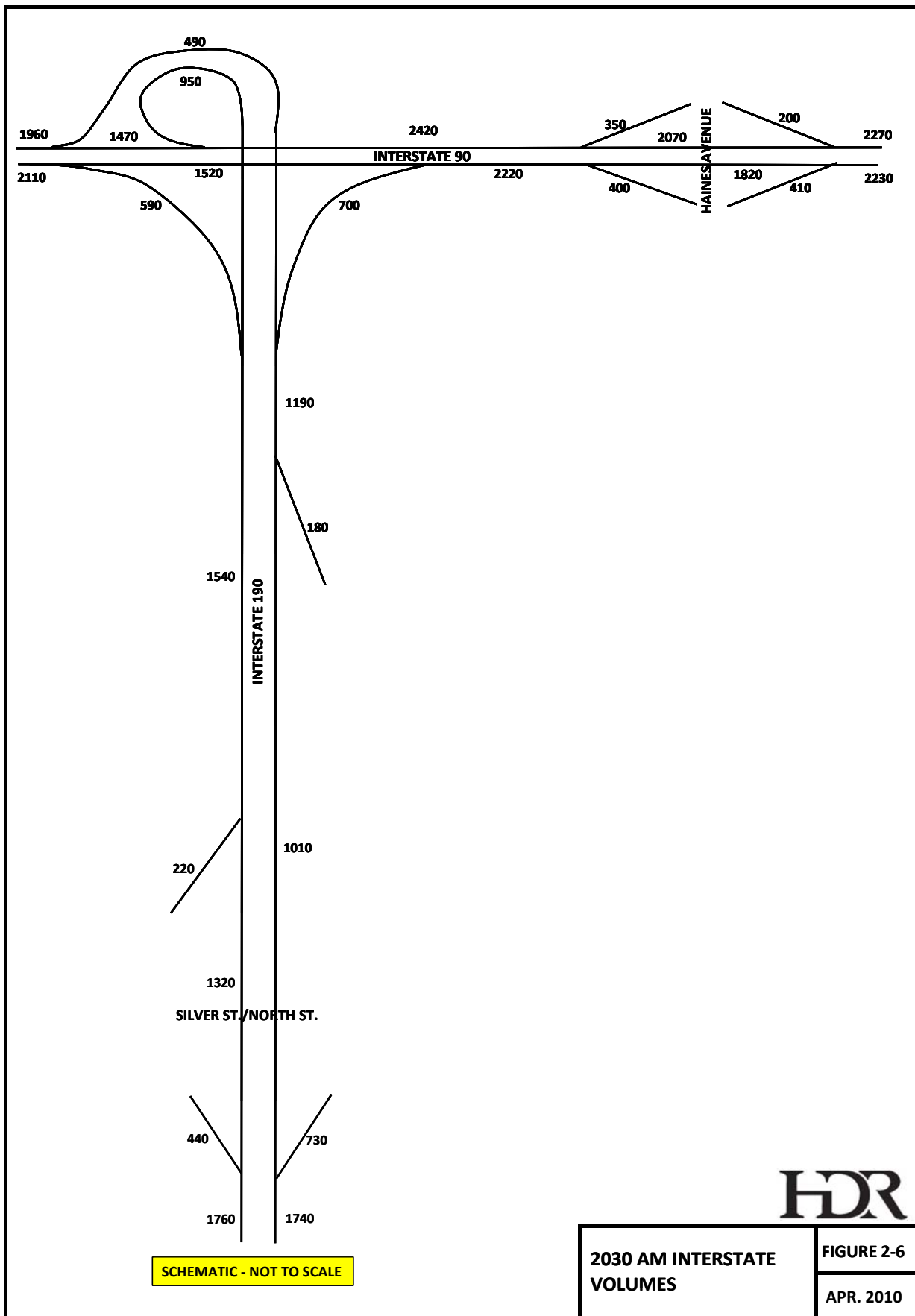
      TRAFFIC SIGNAL

      STOP SIGN

—      EXISTING ROADS





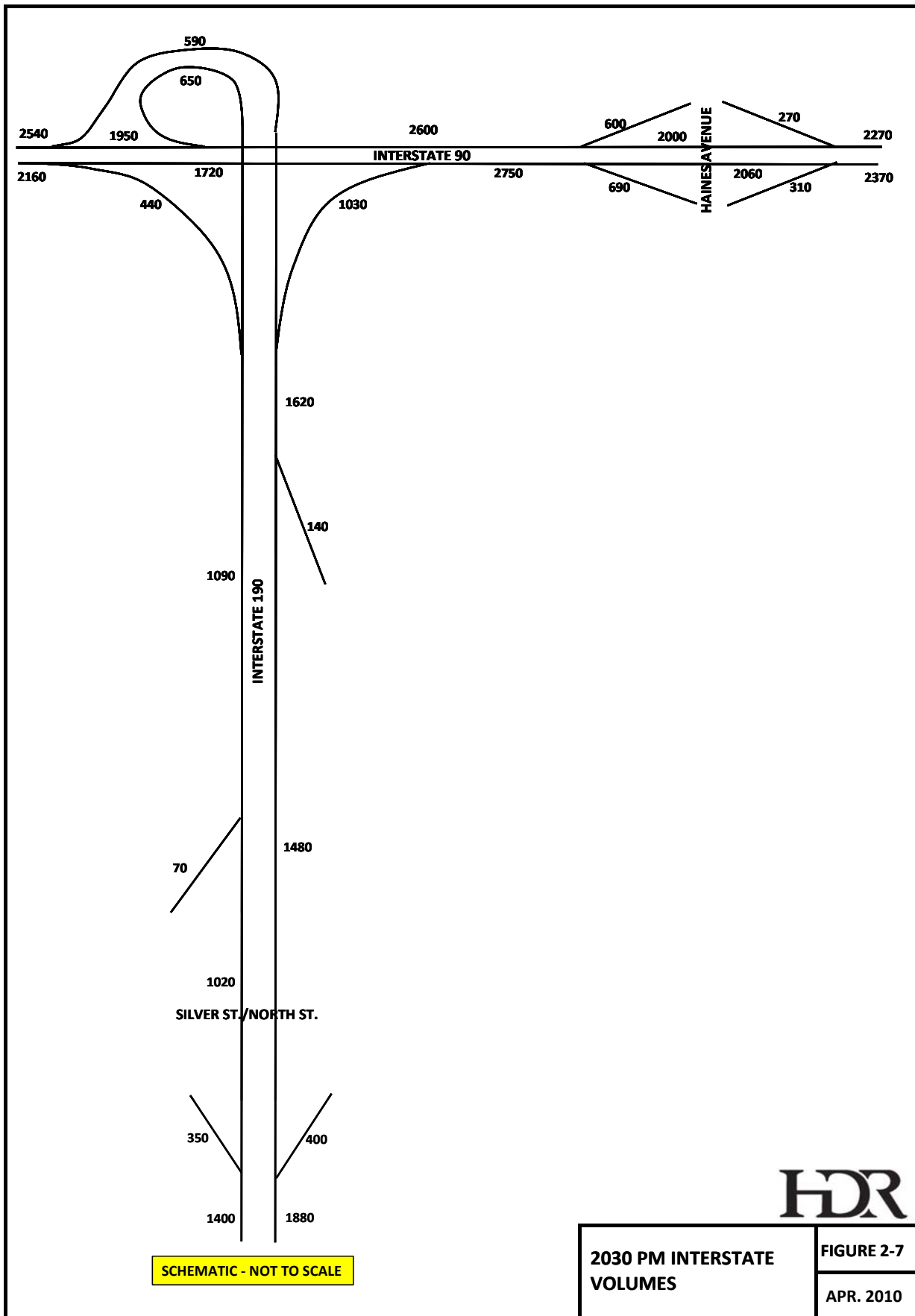


2030 AM INTERSTATE  
VOLUMES

FIGURE 2-6

APR. 2010

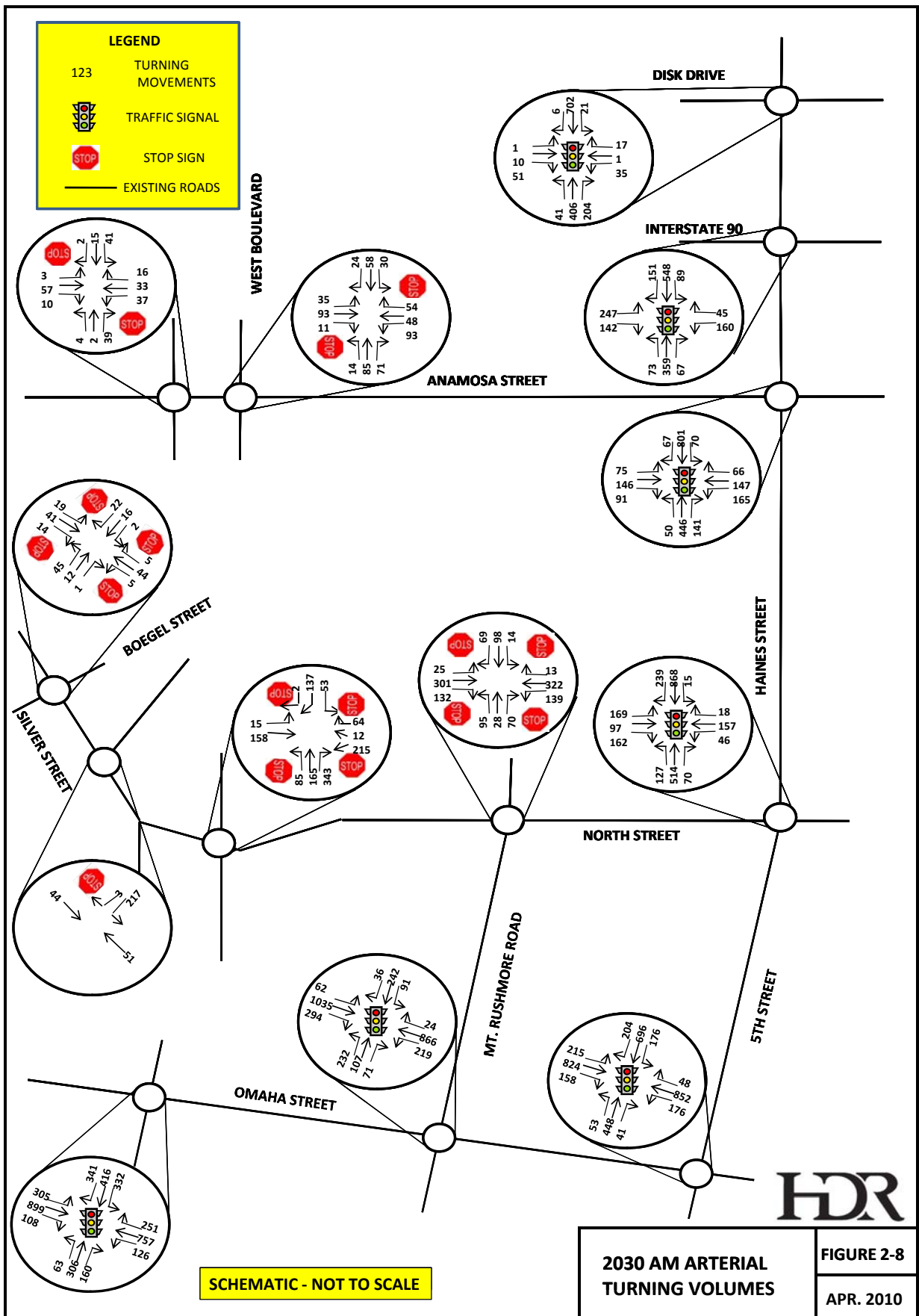


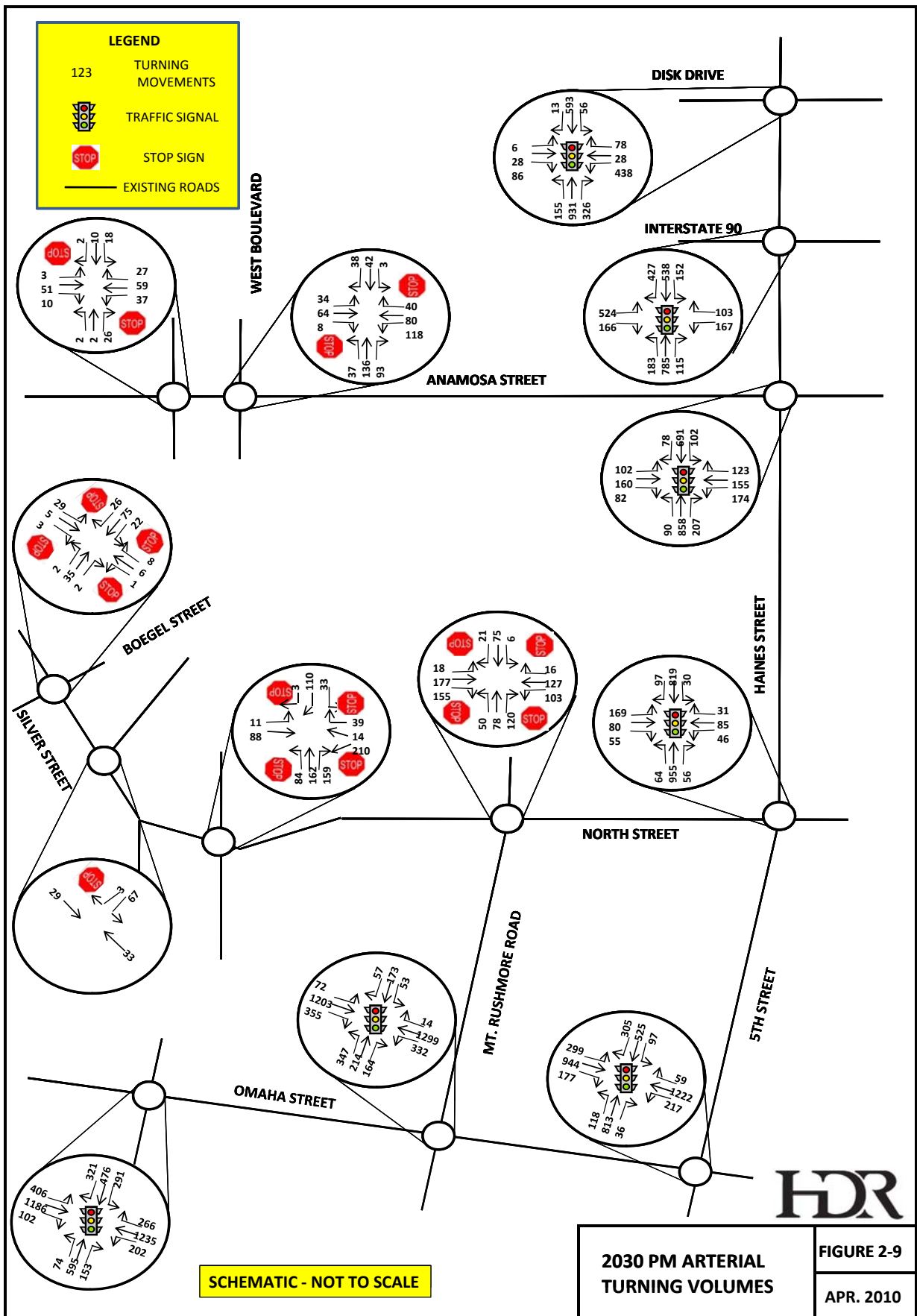


2030 PM INTERSTATE  
VOLUMES

FIGURE 2-7

APR. 2010





**Subtask 105 – Review peak hour movement forecasts with SDDOT and City.** Graphics showing the movement forecasts were delivered to SDDOT on 4/23/10 for distribution and review.

**Subtask 106 – Create study area operations models and analyze existing conditions.** Operations models were created and Interstate and arterial operations were analyzed. Summaries of the operations analysis results are shown in Tables 2-1 to 2-4. The analyses indicate acceptable Interstate mainline levels of service, with all segments operating at LOS A or B under 2010 conditions. Likewise, the Interstate ramps and weave locations operate at LOS A or B under 2010 traffic conditions. The 2010 arterial intersection levels of service for the study area intersections are also acceptable, ranging from LOS A to C. Analysis outputs are provided in the Appendix.

**Subtask 107 – Update models for future year No Action conditions and repeat analysis.** The operations models were updated with the future year traffic forecasts and the operations analysis was repeated, with results shown in Tables 2-1 to 2-5. A number of Interstate mainline segments were seen to fall to LOS C by 2030, but all segments remained within the acceptable range. All the Interstate ramps remained within acceptable levels of service in 2030, except the eastbound I-90 off ramp at Haines Avenue, which operates at LOS F. Interstate weave sections continue to operate at acceptable level of service through 2030. Arterial intersection levels of service are acceptable through 2030, except the intersection of Disk Dr./Haines Ave., which operates at LOS D in the 2030 PM peak hour. Analysis outputs are provided in the Appendix.

**TABLE 2-1 - INTERSTATE MAINLINE LEVEL OF SERVICE (No-Build Alternative)**

ROUTE	FROM	TO	2010		2030	
			AM	PM	AM	PM
I-190 NB	OMAHA ST.	SILVER ST.	A	A	B	C
	SILVER ST.	ANAMOSA ST.	A	A	B	B
	ANAMOSA ST.	I-90	A	A	B	B
I-190 SB	I-90	SILVER OFF	A	A	B	B
	SILVER OFF	SILVER ON	A	A	B	A
	SILVER ON	OMAHA ST.	A	A	B	B
I-90 EB	DEADWOOD ST.	I-190 OFF	A	A	C	C
	I-190 OFF	I-190 ON	A	A	B	B
	I-190 ON	HAINES OFF	A	A	B	B
	HAINES OFF	HAINES ON	A	A	B	B
	HAINES ON	LACROSSE OFF	A	A	C	C
I-90 WB	LACROSSE ON	HAINES OFF	A	A	C	C
	HAINES OFF	HAINES ON	A	A	B	B
	HAINES ON	I-190 OFF	A	A	B	B
	I-190 OFF	I-190 ON	A	A	B	B
	I-190 ON	DEADWOOD ST.	A	B	B	C

**TABLE 2-2 - INTERSTATE RAMP LEVEL OF SERVICE  
(No-Build Alternative)**

ROUTE	RAMP	2010		2030	
		AM	PM	AM	PM
I-190 NB	SILVER OFF	A	B	B	B
	ANAMOSA ON	A	B	B	B
	I-90 OFF	A	A	A	A
I-190 SB	I-90 ON	A	A	B	B
	SILVER OFF	A	A	B	A
	SILVER ON	A	A	B	A
I-90 EB	I-190 OFF	A	A	B	B
	I-190 ON	A	A	B	C
	HAINES OFF	A	B	C	F
	HAINES ON	A	A	B	B
I-90 WB	HAINES OFF	A	A	B	B
	HAINES ON	A	B	B	C
	I-190 OFF	A	A	A	A
	I-190 ON	A	A	A	A

**TABLE 2-3 - INTERSTATE WEAVE LEVEL OF  
SERVICE (No-Build Alternative)**

ROUTE	FROM	TO	2010		2030	
			AM	PM	AM	PM
I-190 NB	ANAMOSA	I-90	A	A	B	B
I-90 EB	I-190	HAINES	A	B	C	C



**TABLE 2-4 - LEVEL OF SERVICE SUMMARY**  
**STREET INTERSECTIONS**  
**EXISTING CONDITIONS**

INTERSECTION	LEVEL OF SERVICE		V/C RATIO	
	AM	PM	AM	PM
HAINES/DISK	A	C	0.31	0.63
HAINES/I-90	A	B	0.26	0.56
HAINES/ANAMOSA	C	B	0.59	0.63
HAINES/NORTH	B	A	0.61	0.54
5TH/OMAHA	C	C	0.51	0.67
MT. RUSHMORE/NORTH	A	A	0.42	0.38
MT. RUSHMORE/OMAHA	C	C	0.57	0.62
WEST/ANAMOSA (W)	A	A	0.27	0.36
WEST/ANAMOSA (E)	A	A	0.25	0.25
BOEGEL/SILVER	A	A	0.21	0.24
WEST/NORTH	B	A	0.34	0.33
WEST/OMAHA	C	C	0.57	0.73

**TABLE 2-5 - LEVEL OF SERVICE SUMMARY**  
**STREET INTERSECTIONS**  
**2030 CONDITIONS, EXISTING NETWORK**

INTERSECTION	LEVEL OF SERVICE		V/C RATIO	
	AM	PM	AM	PM
HAINES/DISK	A	D	0.37	0.79
HAINES/I-90	A	B	0.45	0.65
HAINES/ANAMOSA	C	C	0.65	0.68
HAINES/NORTH	B	B	0.70	0.65
5TH/OMAHA	C	C	0.70	0.82
MT. RUSHMORE/NORTH	C	B	0.57	0.41
MT. RUSHMORE/OMAHA	C	C	0.66	0.66
WEST/ANAMOSA (W)	A	A	0.28	0.28
WEST/ANAMOSA (E)	A	A	0.35	0.46
BOEGEL/SILVER	A	A	0.25	0.29
WEST/NORTH	C	B	0.58	0.50
WEST/OMAHA	C	C	0.62	0.92

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**Subtask 108 – Crash analysis.** Crash data for the study area was provided in a geo-referenced database, displayed in ArcGIS format. The GIS allowed display of crash locations on top of a study area map and easy identification of crash clusters and potential crash problems needing improvements.

Overall, the Interstate system showed randomly scattered crashes, with two exceptions – the I-90/I-190 interchange area and the weave area on eastbound I-90, between I-190 and Haines Avenue.



**Figure 2-10 – Crash display I-90/I-190 interchange area**

The I-90/I-190 interchange area (Figure 2-10), showed a slight concentration of crashes, but analysis of the crash records showed no trend toward any particular type of crash. Rather, crashes appear to be related to operating on hills and curves during winter driving conditions, as well as a number of animal-related crashes. No particular road-related remedy is suggested, although continued attention to winter maintenance may help control crash rates.

The crash rate for the eastbound I-90 segment between I-190 and Haines Avenue (Figure 2-11) appears fairly high, although the rate may be skewed by the short length of the segment. Review of the crash details shows that 83% of the crashes occurred in



inclement driving conditions. Again, continued attention to winter maintenance may help control crash rates.

Interstate segment crash rates are shown in Table 2-6.



Figure 2-11 – Crash display I-90 between I-190 and Haines Avenue

TABLE 2-6 - INTERSTATE AREA CRASH RATES

AREA	CRASHES	MILEAGE	AADT	CRASH RATE (CRASHES PER MILLION VEHICLE MILES)
I-90/I-190 INTERCHANGE	31	2.9	8300	1.18
I-90 EASTBOUND WEAVE, I-190 TO HAINES	12	0.14	16190	4.83

Intersection crash rates for the arterial street intersections are shown in Table 2-7. The critical crash rate that triggers improvement can vary from community to community and year to year, depending on the statistical analysis of crash rates from a large population of intersections. While the small number of intersections in this study do not permit

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calculation of a critical crash rate, arterial intersection critical rates in South Dakota usually range in the vicinity of 0.80 – 1.20 crashes per million entering vehicles. This would point toward the following intersections as potential candidates for improvement:

- Omaha St./West Blvd./I-190
- Omaha St./5<sup>th</sup> St.
- North St./Mt. Rushmore Rd.
- Haines St./I-90
- Haines St./Disk Dr.

Since this study is limited to a small number of arterial intersections, it was possible to review the crash records for each intersection to look for trends and indications of potential problems. The crash location display for each intersection is shown starting on the following page, along with a short summary of the findings.

**TABLE 2-7 - INTERSECTION CRASH RATES**

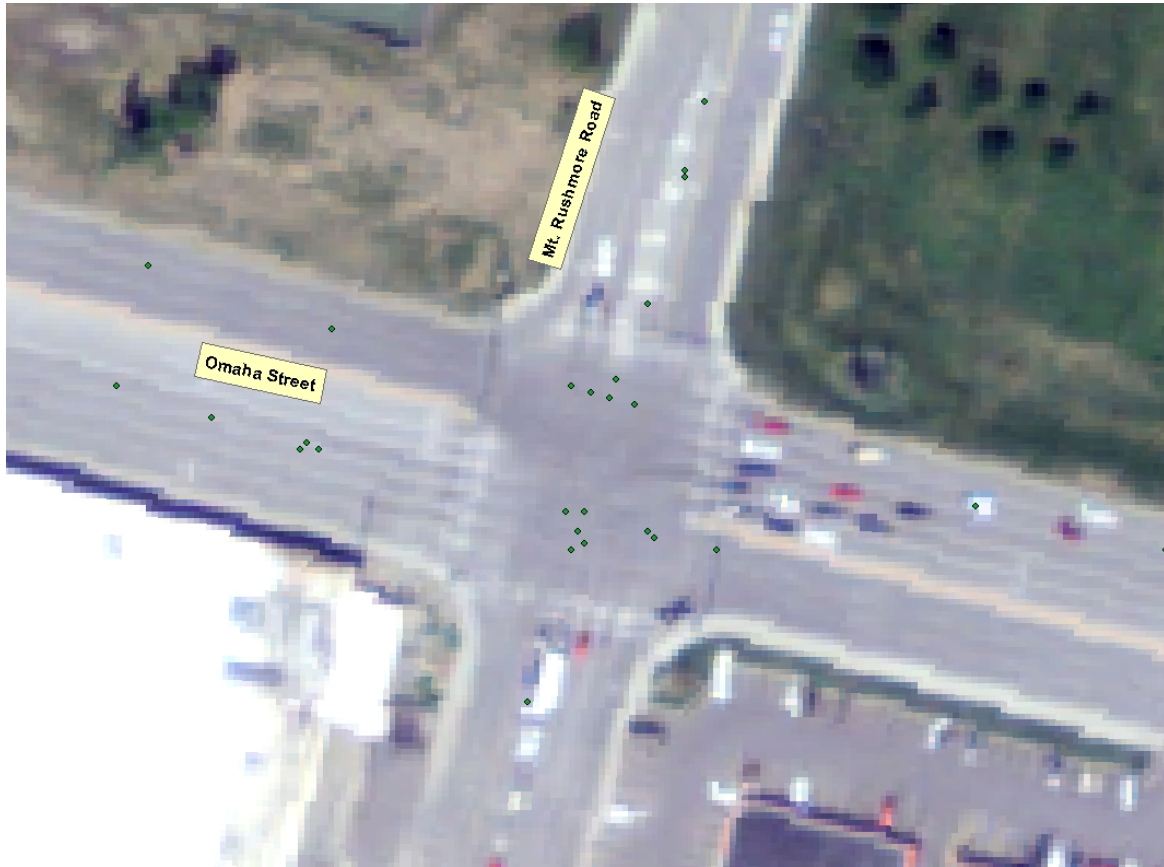
<b>INTERSECTION</b>	<b>NUMBER OF CRASHES</b>	<b>DAILY VEHICLES</b>	<b>CRASH RATE (CRASHES PER MILLION ENTERING VEHICLES)</b>
OMAHA/WEST/I-190	72	59,700	1.10
OMAHA/MT. RUSHMORE	28	32,600	0.78
OMAHA/5TH	57	49,900	1.04
NORTH/WEST/SILVER	7	8,000	0.80
NORTH/MT. RUSHMORE	10	8,000	1.14
HAINES/5TH/NORTH	15	24,000	0.57
HAINES/ANAMOSA	16	25,100	0.58
WEST/ANAMOSA	3	6,000	0.46
HAINES/I-90	40	25,900	1.41
HAINES/DISK	31	27,800	1.02



#### Omaha St./West Blvd./I-190

A total of 72 crashes were reported in three years (2007, 2008, 2009). Over 72% of the crashes were rear-end, while over 18% were angle crashes. The crash display indicates that many of the crashes are occurring after vehicles have crossed the stop-bar and entered the intersection. This suggests that rear-end crashes may be occurring due to downstream congestion and downstream merging. Some potential countermeasures may include:

- Downstream acceleration lane for southbound to westbound right turn.
- Check peak hour queues on southbound West Boulevard.
- Check lane marking for double left turn lanes to reduce vehicles drifting into others' paths.



Omaha St./Mt. Rushmore Rd.

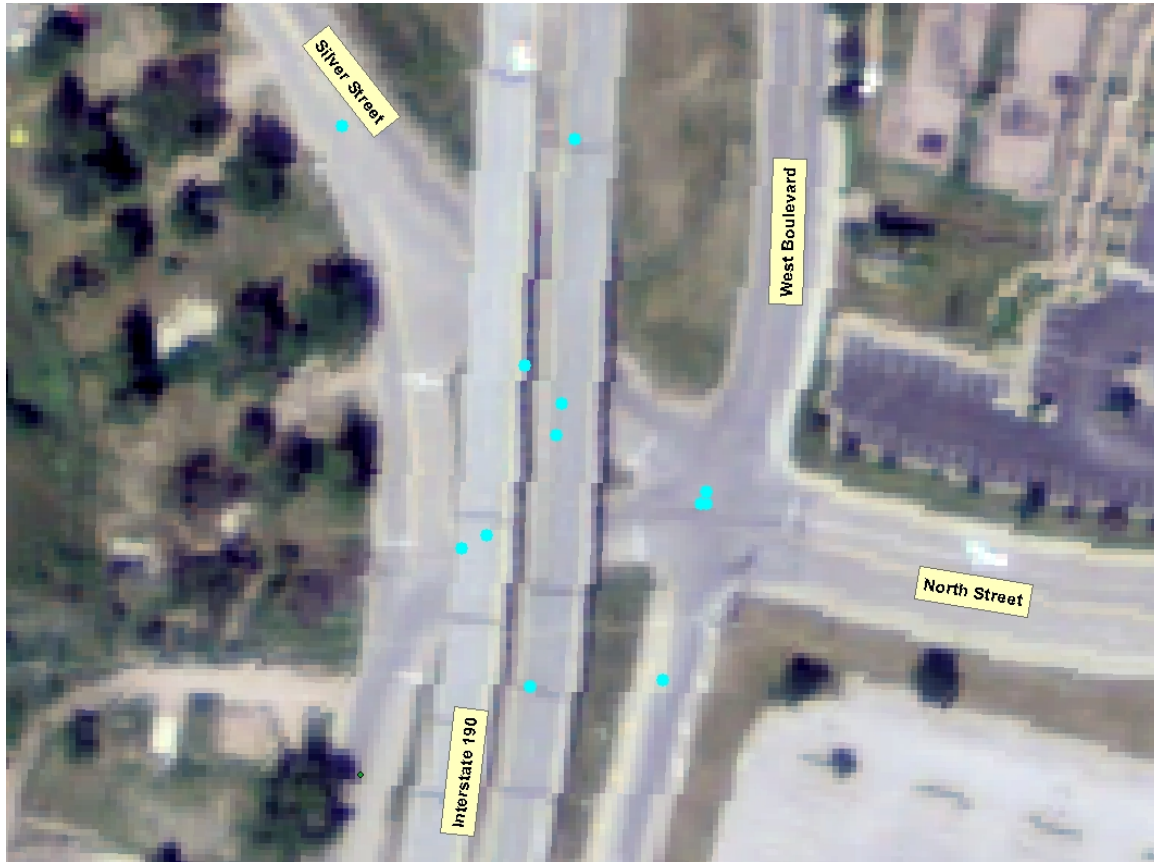
A total of 28 crashes were reported in three years (2007 – 2009), split primarily between rear-end (50%) and angle (32%) crashes. Crash locations are scattered around the intersection, although a concentration may be developing related to the westbound to southbound left turn. No other trends were noted or improvements suggested.





#### Omaha St./5<sup>th</sup> St.

A total of 57 crashes were reported in three years (2007 – 2009), split primarily between rear-end (72%) and angle (21%) crashes. The majority of the crashes appear to be occurring in the center of the intersection in line with left turn lanes. It is possible that some of the rear-end accidents are occurring due to downstream congestion, perhaps related to railroad operations in the vicinity.



I-190/West Blvd./Silver St./North St.

A total of 13 crashes were reported at this location, but 6 of the 13 were single-vehicle crashes actually on I-190 in inclement weather conditions. Seven of the 13 were listed as intersection-related. There were an insufficient number of crashes to establish trends or suggest crash-related improvements.





Mt. Rushmore Rd./North St./Allen St.

A total of 10 crashes were reported in three years (2007 – 2009), split primarily between rear-end (30%) and angle (60%) crashes. The intersection is currently operating with all-way stop control. Intersections of this type typically have a slightly higher critical crash rate than larger signal-controlled arterial intersections. It appears that the crash rate at this intersection may not be critical and that the majority of the crashes are related to driver difficulties in determining right-of-way. The location does not currently meet the number of crashes necessary to warrant conversion to a traffic signal, but conditions should continue to be monitored in the future.



Haines Ave./5<sup>th</sup> St./North St.

A total of 15 crashes were reported in three years (2007 – 2009), split primarily between rear-end (27%) and angle (67%) crashes. Most of the crashes were related to drivers failing to yield or not obeying the traffic signals. No other trends were noted and the crash rate does not appear to be critical. No crash-related improvements are suggested.



Haines Ave./Anamosa St.

A total of 16 crashes were reported in three years (2007 – 2009), split primarily between rear-end (31%) and angle (50%) crashes. Most of the crashes were related to drivers failing to yield or not obeying the traffic signals. No other trends were noted and the crash rate does not appear to be critical. No crash-related improvements are suggested.



Anamosa St./West Blvd.

A total of 3 crashes were reported in three years (2007 – 2009). No trends were noted and the crash rate does not appear to be critical. No crash-related improvements are suggested.





#### I-90/Haines Ave.

A total of 40 crashes were reported in the interchange area in a three year period (2007-2009). A large portion of the crashes (43%) occurred during inclement driving conditions and it appears that a significant number involved single-vehicle incidents on I-90. A cluster of rear-end crashes appears to be developing in the southbound lanes of Haines Ave., south of the interchange. One potential cause for this cluster may be the interaction of vehicles trying to turn left onto Knollwood Dr. The intersection influence areas of these two intersections appear to overlap, making it difficult for drivers to react in time to avoid collisions. While Knollwood Drive serves businesses and residences fronting I-90, safety concerns may require rerouting Knollwood traffic in the future.



#### Haines Ave./Disk Drive

A total of 31 crashes were reported in the three reporting years (2007-2009). They were comprised primarily of rear-end (45%) and angle (48%) crashes. Failure to yield citations were prevalent in the crash records, indicating that some drivers may be using the yellow, all-red and red portions of the turning phases to continue to turn under congested conditions. The intersection crash rate may not reach the critical threshold in a city-wide statistical analysis, but operations at the intersection should be reviewed as development continues and volumes rise.

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## Chapter 3 – Develop Interstate Improvement Options

Concepts were developed to address the Interstate System deficiencies identified in Chapter 1. The concepts centered on improving the configuration of the Silver Street interchange, but did not address the issue of the improper termination of I-190 in an at-grade signalized intersection. The subject of whether Interstate 190 should remain part of the Interstate Highway System is discussed in Chapter 5.

**Subtask 201: Develop Interstate 190 mainline design concepts.** No mainline design deficiencies were identified, other than the non-standard ramp locations that will be addressed in Subtask 202.

**Subtask 202: Develop options for the I-190/Silver St. interchange.** Diamond, single-point and parclo concepts were developed for replacement of the I-190/Silver St. interchange. Each of the concepts also included options for using the existing Silver St./North St. cross-road alignment and for using a new cross-road configuration with a more east/west alignment. Each of the concepts is discussed below and displayed in the concept drawings that accompany this report.

- Option 1 – Full diamond interchange at Silver Street/North Street with I-190 shifted west. Shifting the I-190 alignment to the west allows for sufficient room to build all interchange options and provide adequate turn lanes and other geometric features. The southbound I-190 ramp terminal in this option suffers from a fairly high degree of skew on the cross-road and subsequent sharp turning paths on some movements. The mainline bridges would be relatively long due to the cross-road skew. Additional right-of-way will be needed west of the existing I-190, although some of the needed property is already in public ownership. Additional local street connections will be needed west of the interchange to facilitate local traffic movement. The parking lots at Central High School will no longer be allowed to access the Interstate off ramp in this concept. The ramp in the northeast quadrant may also provide limited local street access for a short distance before the actual entrance ramp begins (optional).
- Option 1a – Full diamond interchange at North Street with I-190 shifted west. This option is similar to option 1, except the cross-road has been realigned to connect to the new local street west of the interchange. The geometry of the ramp terminal intersections is improved over Option 1 and the interchange bridges would be shorter than required for the skewed cross-road in Option 1.
- Option 2 – Single point diamond interchange at Silver Street/North Street with I-190 shifted west. The single-point ramp terminal suffers from a fairly high degree of skew on the cross-road and a large area of pavement for turning movements. The mainline bridges would be relatively long and wide due to the cross-road skew. Additional right-of-way will be needed west of the existing I-190, although some of the needed property is already in public ownership. The additional right-of-way required will be less than Option 1 or Option 1a. Additional local street connections will be needed west of the interchange to facilitate local traffic movement. The parking lots at Central High School will no longer be allowed to access the Interstate off ramp in this concept.
- Option 2a – Single point diamond interchange at North Street with I-190 shifted west. This option is similar to option 2, except the cross-road has been realigned to connect to the new local street west of the interchange. The geometry of the ramp terminal

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intersection is improved over Option 2, less right-of-way will be required than Option 2, and the bridge dimensions are reduced from Option 2

- Option 2 hybrid – An interchange with characteristics of the diamond and single point concepts previously shown. The hybrid configuration attempts to deal with the skew and curvature of the crossroad.
- Option 3 – I-190 interchange with loop at North Street. Connecting the cross-road to the new roadway west of the interchange results in the opportunity to provide a loop ramp to handle one of the largest turning volumes. Eastbound traffic would not be able to turn south at the interchange in this concept, but other local street alternatives are available. The mainline bridges would be relatively short in this option, but the southbound bridge would need to be three lanes wide to handle the accelerating loop traffic. Additional right-of-way will be needed west of the existing I-190, although some of the needed property is already in public ownership. The additional right-of-way required will be larger in the loop quadrant, but less in the southwest quadrant. Additional local street connections will be needed west of the interchange to facilitate local traffic movement. The parking lots at Central High School will no longer be allowed to access the Interstate off ramp in this concept.
- Option 3a – I-190 interchange with loop at North Street and EB to SB access. This concept is similar to Option 3, but a connection is provided for eastbound traffic to access the loop.
- Option 3b – I-190 interchange with Loop at North Street and EB to SB on-ramp. This concept is similar to Option 3, but a southbound on ramp is provided to serve eastbound traffic.
- Other options – additional options were also considered that realign I-190 to connect to Mt. Rushmore Road at Omaha Street. These options are not reproduced here because they interfere with the planned expansion of Central High School and will likely be screened by environmental considerations.

**TABLE 3-1: RAMP TERMINAL LEVEL OF SERVICE (Projected 2030 Traffic)**

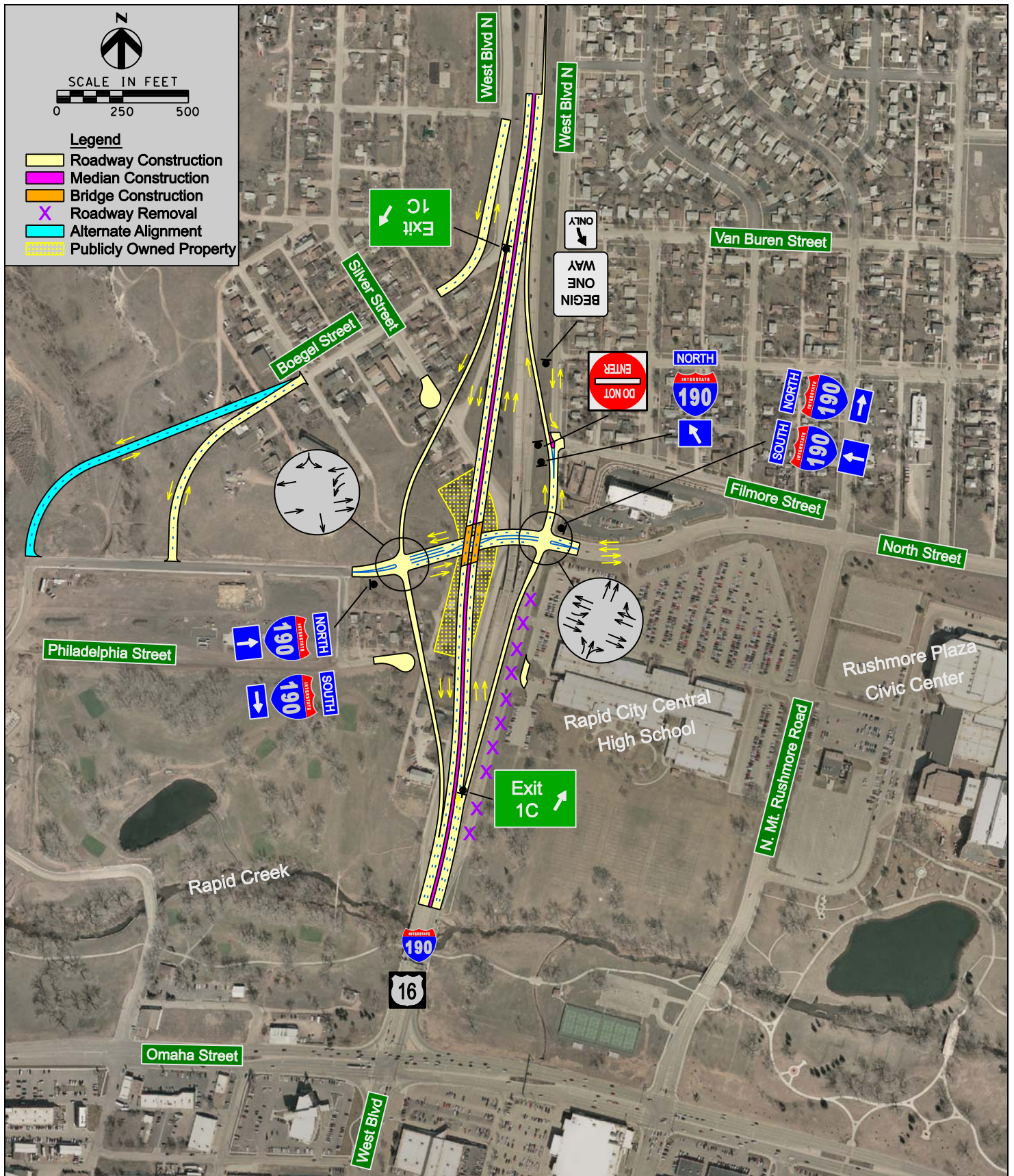
RAMP TERMINAL	LEVEL OF SERVICE	
	AM	PM
DIAMOND SOUTHBOUND	B	B
DIAMOND NORTHBOUND	B	B
SINGLE POINT	B	C
LOOP SOUTHBOUND	A	A
LOOP NORTHBOUND	B	B

**Subtask 203: Present and review concepts.** Concepts were presented to SDDOT staff at a meeting held May 13, 2010 in Pierre. Meeting notes were prepared addressing the comments (Appendix) and the options were finalized for inclusion in this report.



**June 28,  
2010**





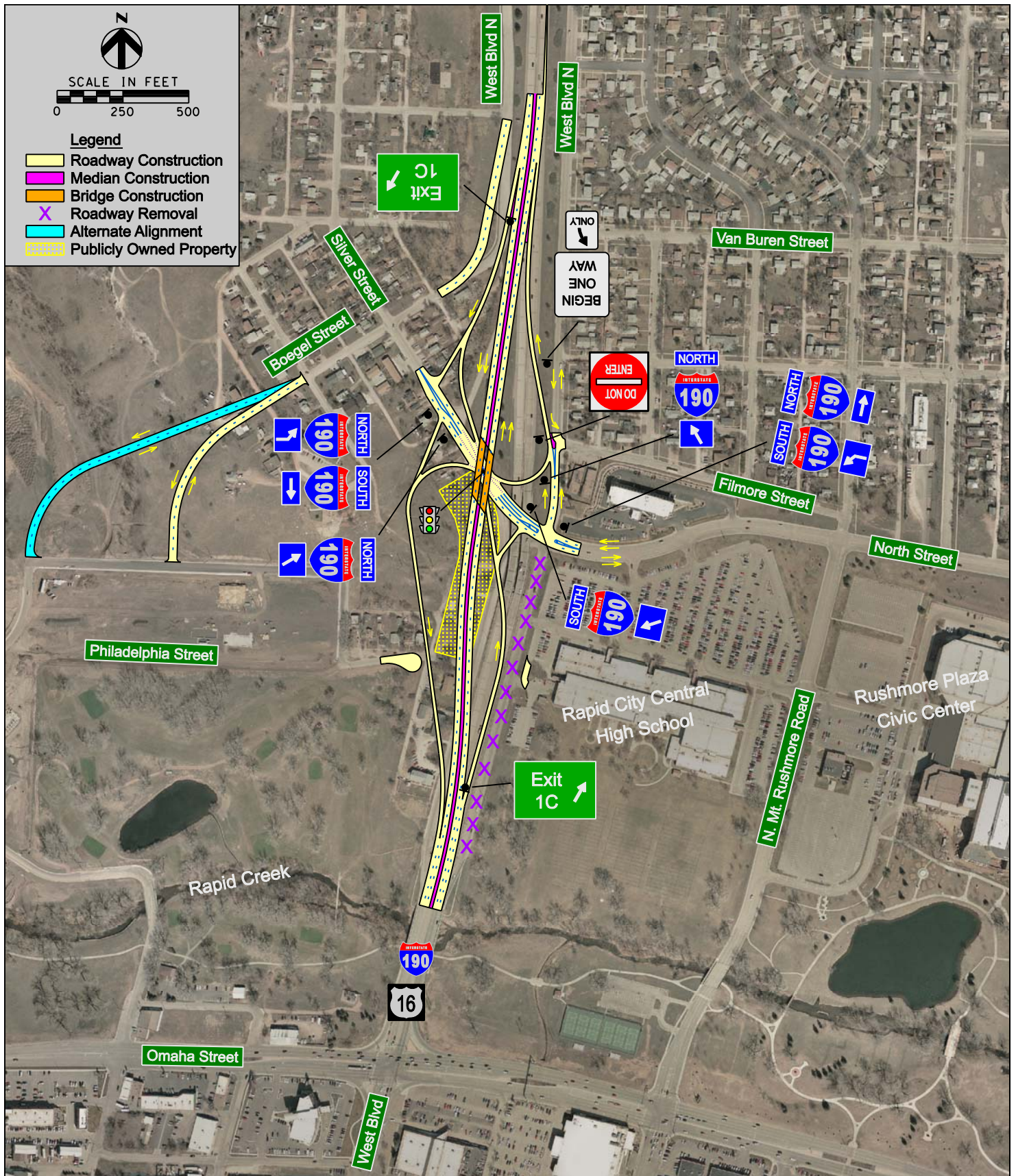
## Interchange Option 1a

Full Diamond Interchange at North Street with I-190 shifted west

Interstate 190/Silver Street Interchange Study  
Rapid City, South Dakota

June 28,  
2010





## Interchange Option 2

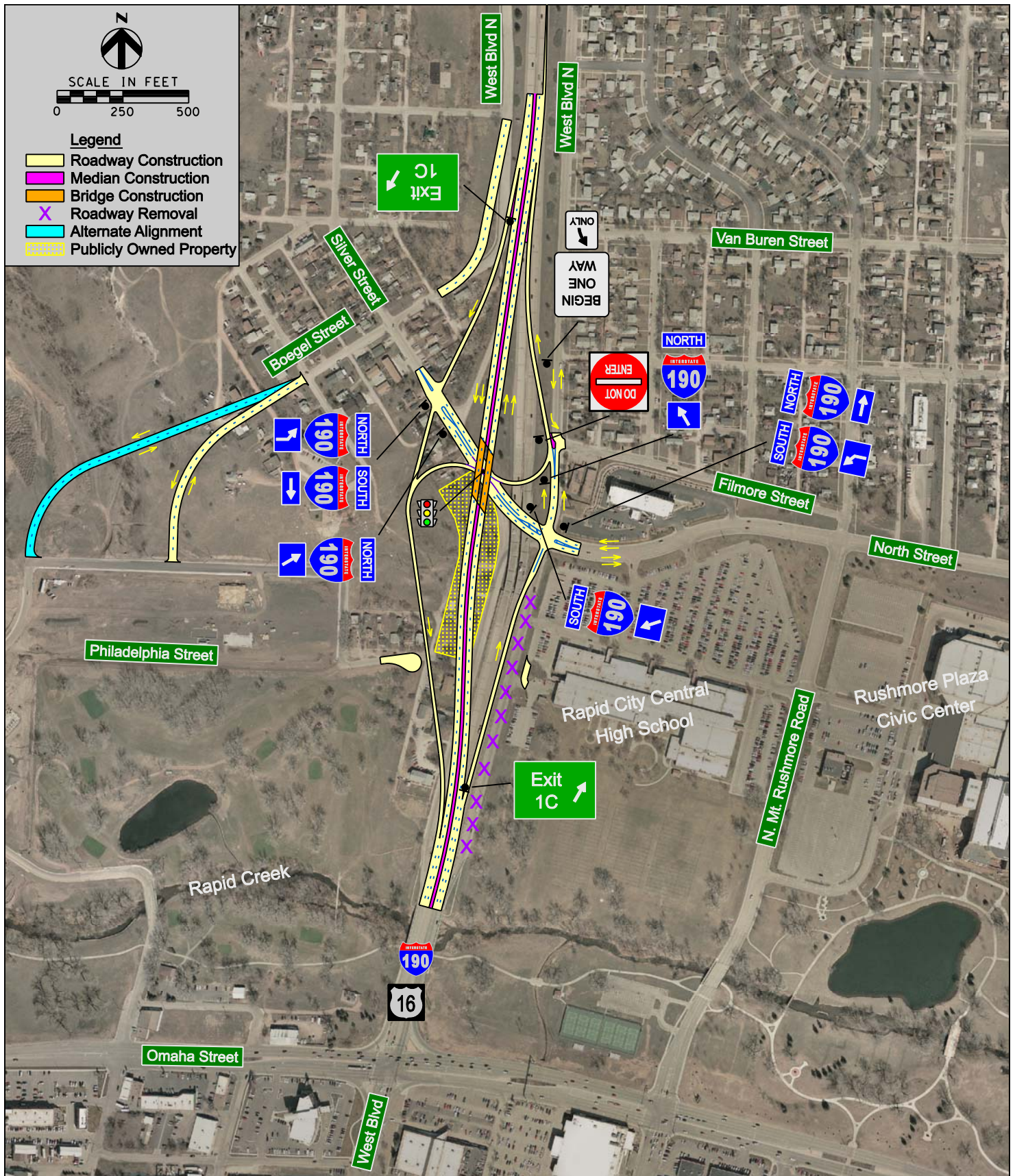
Single Point Diamond Interchange at Silver Street  
with I-190 shifted west

Interstate 190/Silver Street Interchange Study  
Rapid City, South Dakota



June 28,  
2010





## Interchange Option 2 Hybrid

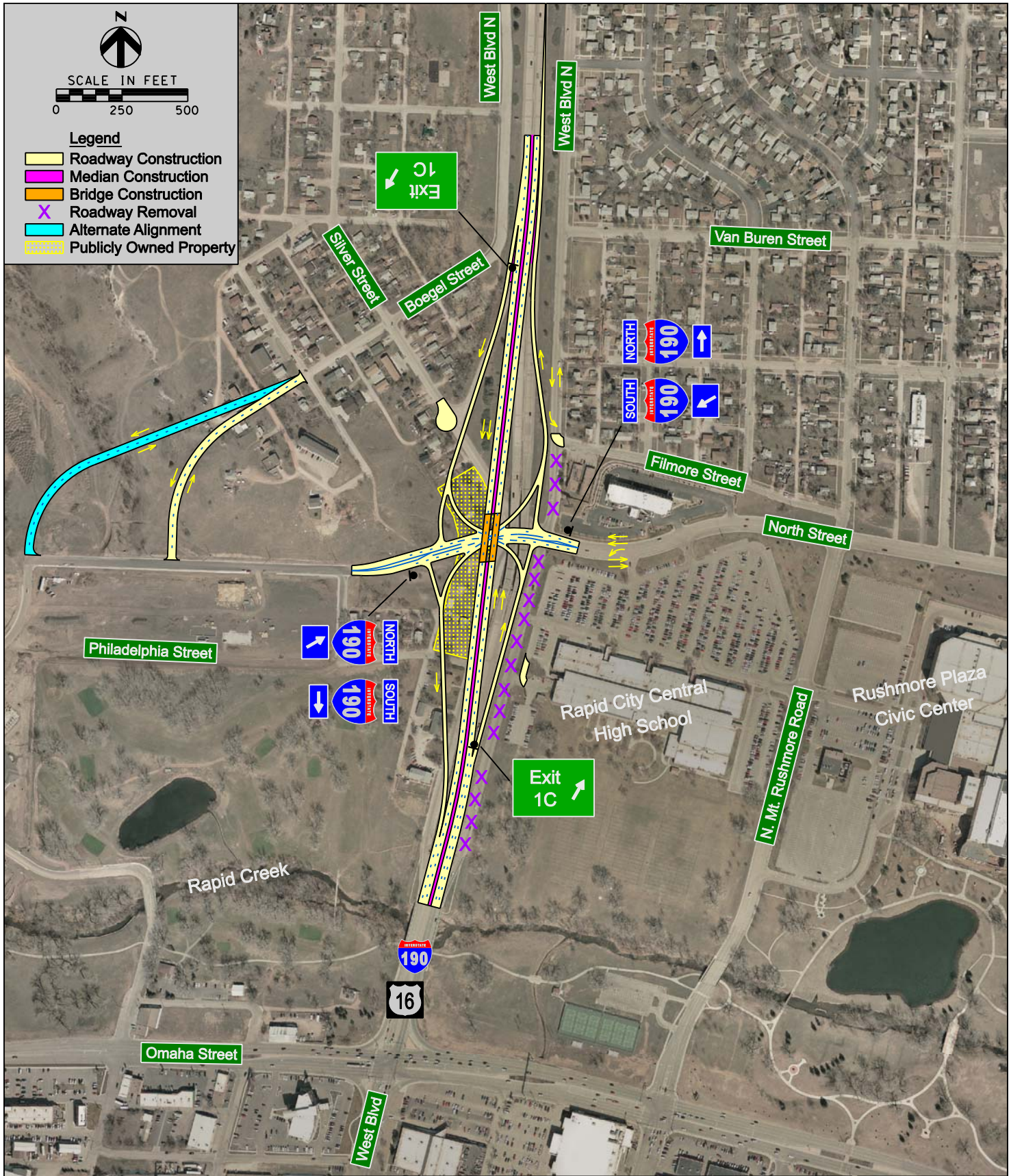
Hybrid Single Point Diamond Interchange at Silver Street  
with I-190 shifted west

Interstate 190/Silver Street Interchange Study  
Rapid City, South Dakota



June 28,  
2010





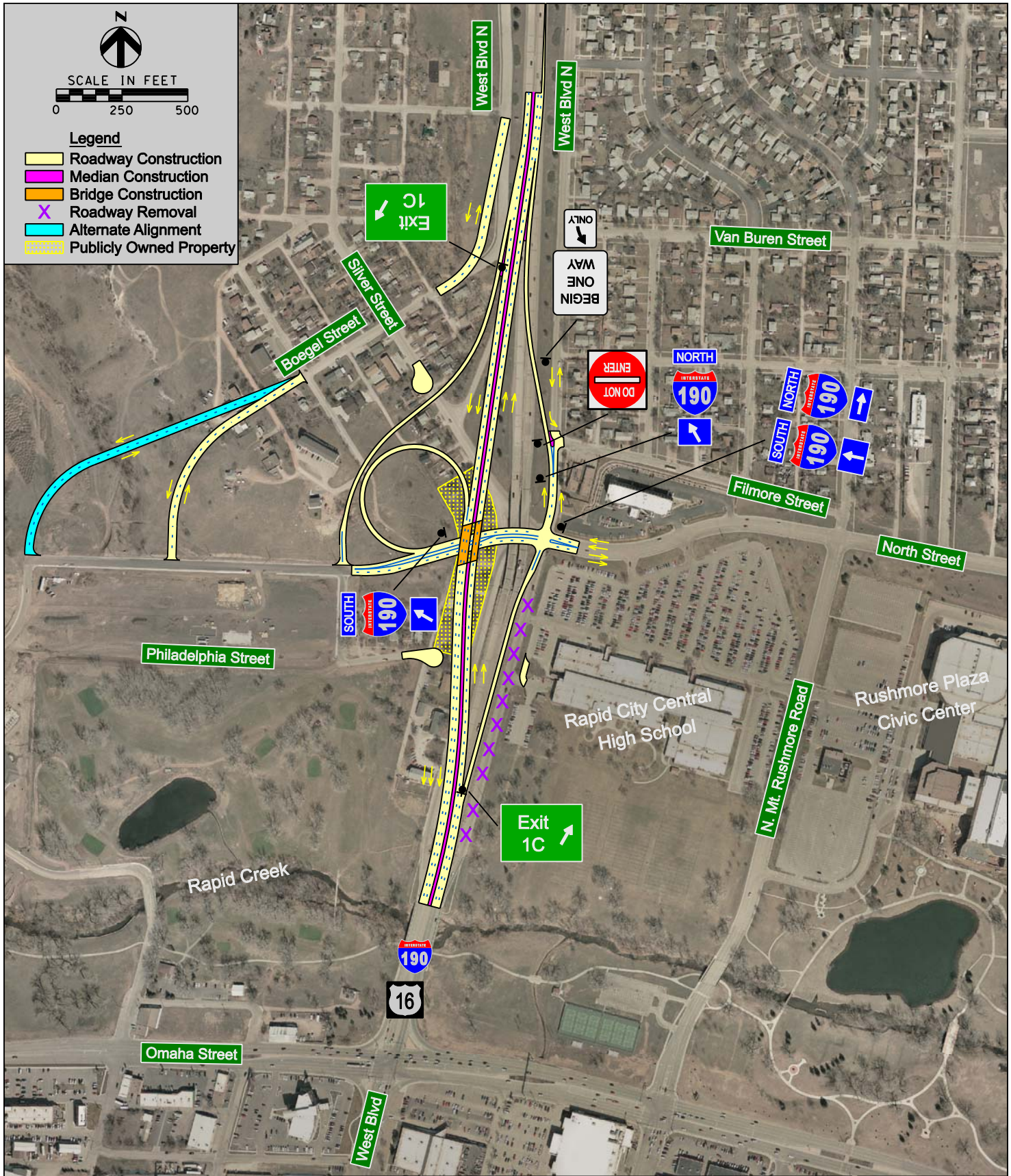
## Interchange Option 2a

Single Point Diamond Interchange at North Street with I-190 shifted west

Interstate 190/Silver Street Interchange Study  
Rapid City, South Dakota

June 28,  
2010





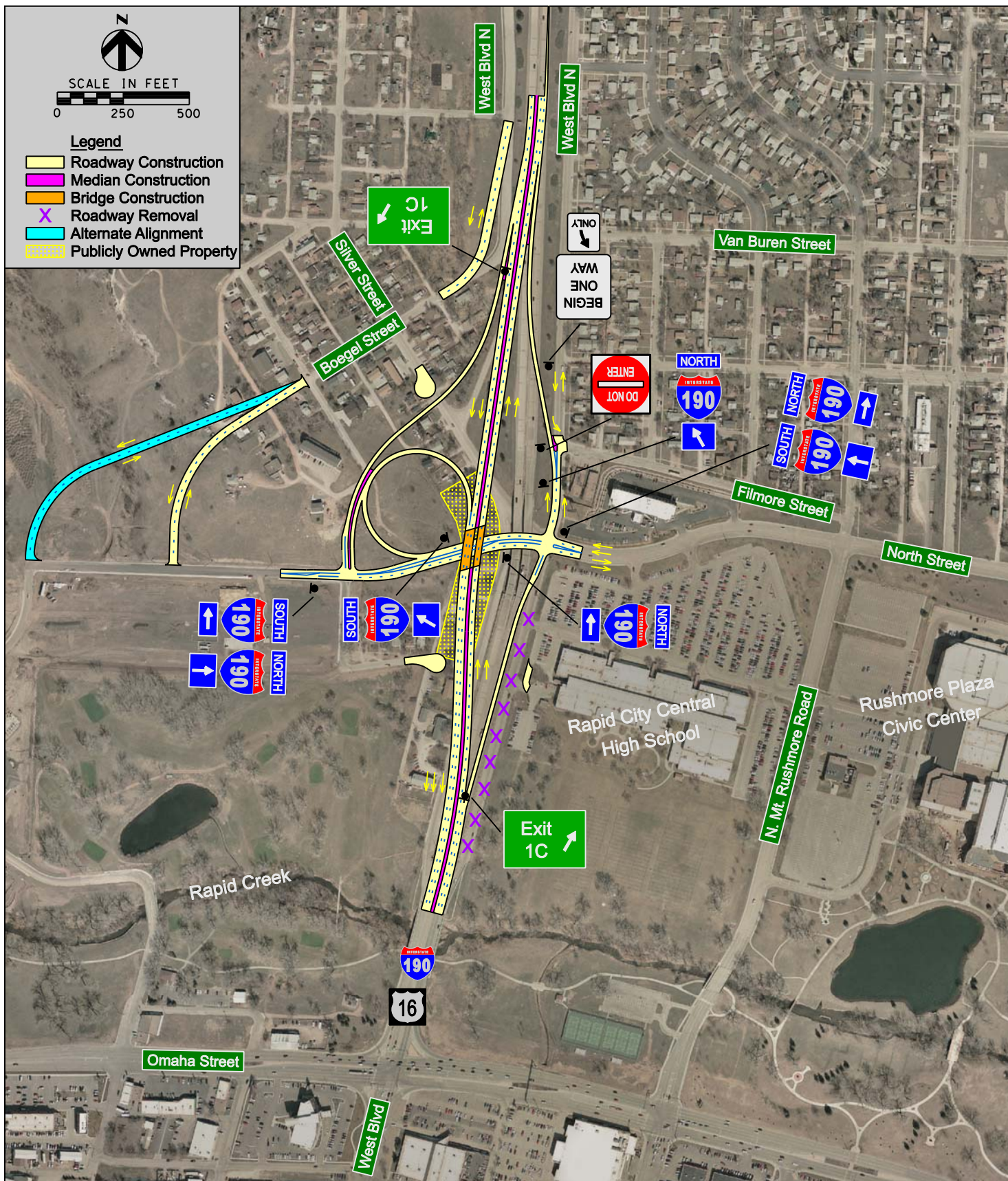
### Interchange Option 3

I-190 Interchange with Loop at North Street

Interstate 190/Silver Street Interchange Study  
Rapid City, South Dakota

June 28,  
2010





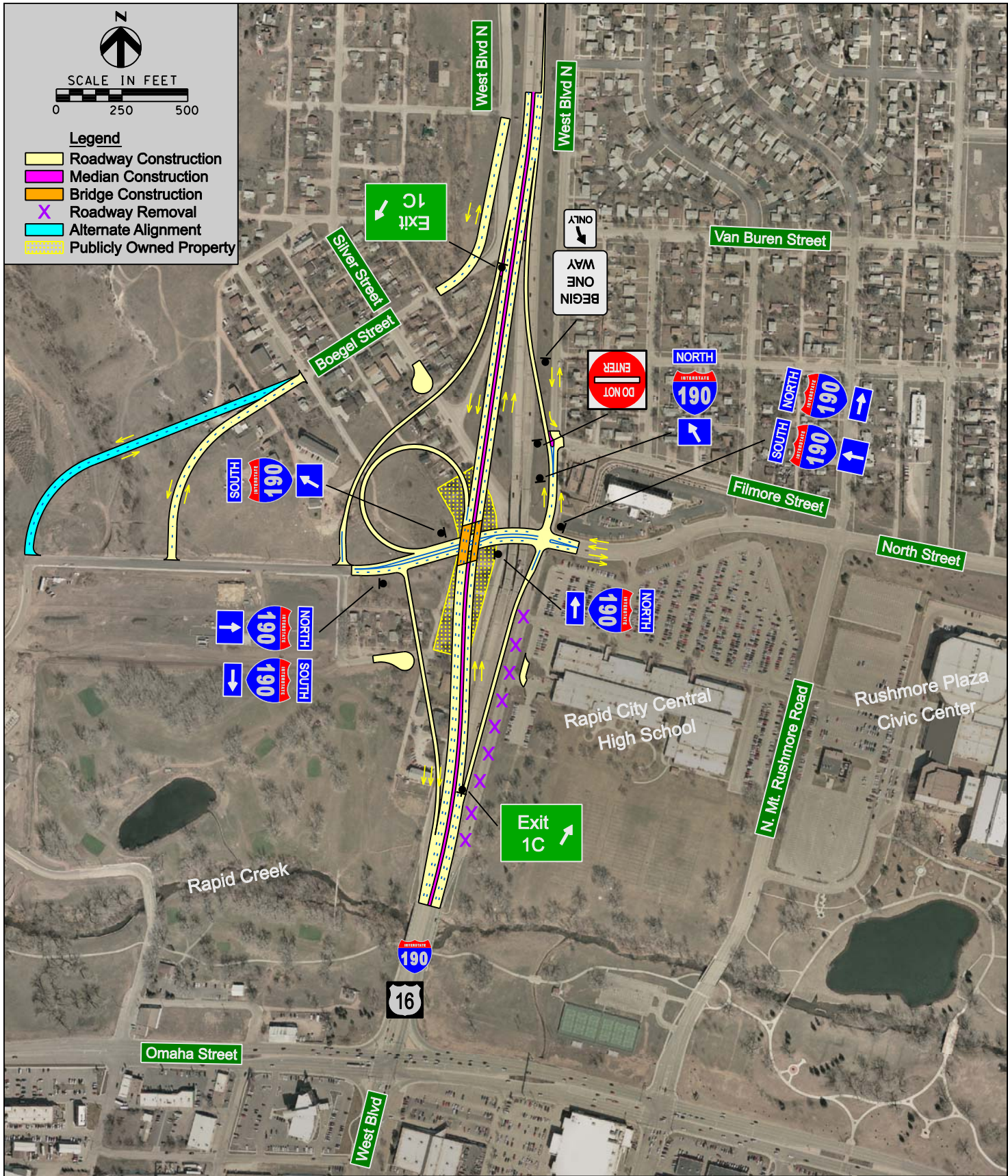
## Interchange Option 3a

I-190 Interchange with Loop at North Street and EB to SB access

Interstate 190/Silver Street Interchange Study  
Rapid City, South Dakota

June 28,  
2010





### Interchange Option 3b

I-190 Interchange with Loop at North Street and EB to SB on-ramp

Interstate 190/Silver Street Interchange Study  
Rapid City, South Dakota

June 28,  
2010



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## Chapter 4 – Develop At-Grade Intersection Options

Concepts were developed to convert the existing I-190/Silver St. interchange to an at-grade intersection. Some version of an at-grade intersection may provide good service for the existing and planned transportation needs, but would not be allowable if I-190 remained on the Interstate Highway System.

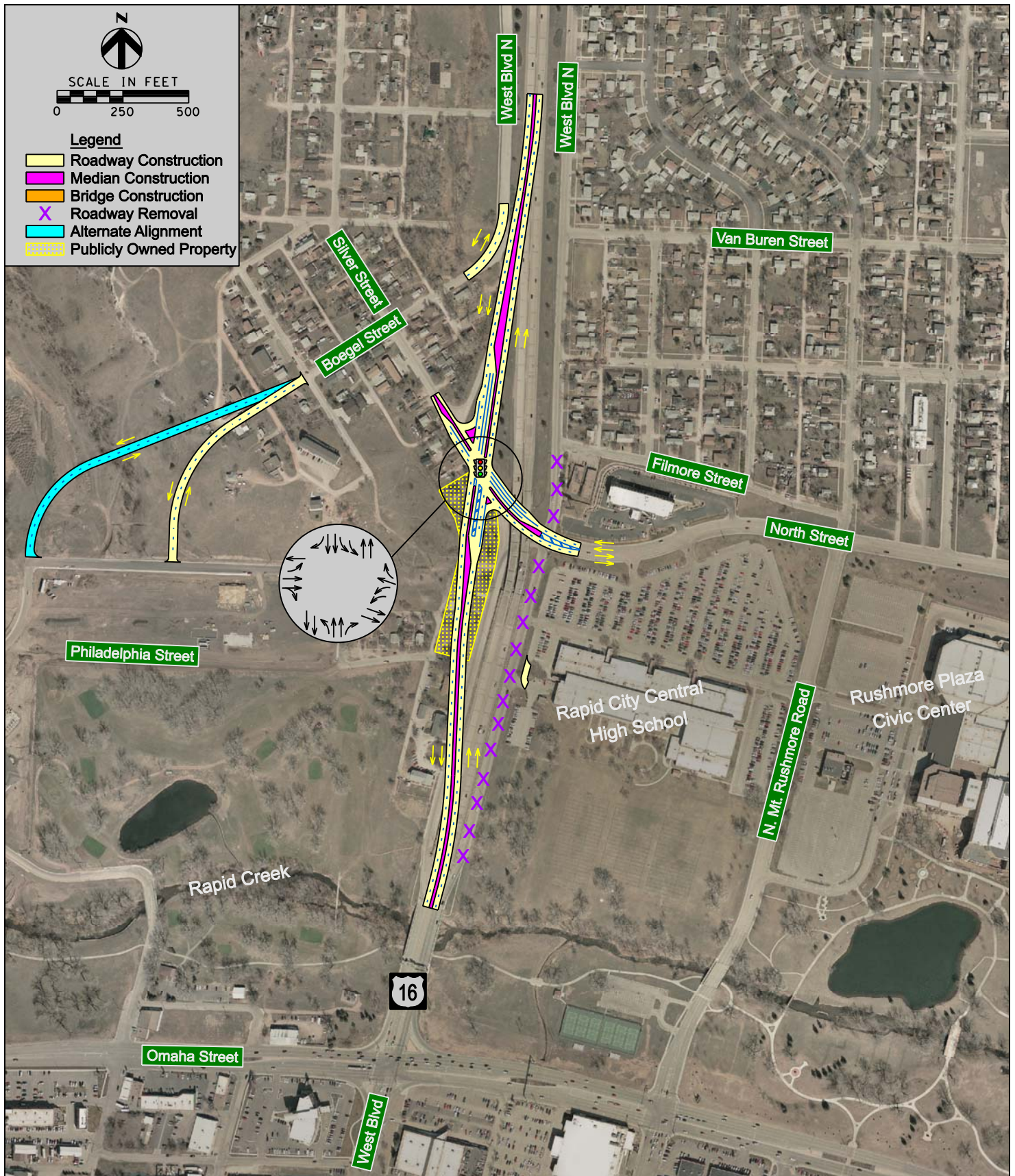
**Subtask 301: Develop options for the US 16/Silver St. intersection.** At-grade signalized intersections were developed for the existing interchange area in the event that it is redesignated as an arterial route, rather than a part of the Interstate system. Each of the concepts is discussed below and displayed in the concept drawings that accompany this technical memorandum.

- Option 4 - Shifting the US 16 alignment to the west allows for sufficient room to build all intersection options and provide adequate turn lanes and other geometric features. The intersection in this option suffers from a fairly high degree of skew on the cross-road and subsequent sharp turning paths on some movements. Additional right-of-way will be needed west of the existing US 16, although some of the needed property is already in public ownership. Additional local street connections will be needed west of the intersection to facilitate local traffic movement. The parking lots at Central High School will no longer be allowed to access the Interstate off ramp in this concept. The intersection of North Street and the east frontage road (West Blvd.) has been removed to allow sufficient vehicle storage and remove conflict points.
- Option 4a - This option is similar to Option 4, except the cross-road has been realigned to connect to the new local street west of the intersection. The geometry of the intersection is improved over Option 4.
- Other options - additional options were also considered that realign US 16 to connect to Mt. Rushmore Road at Omaha Street. These options are not reproduced here because they interfere with the planned expansion of Central High School and will likely be screened by environmental considerations. A roundabout option was also considered, but not fully developed because a roundabout at this intersection would also require extensive redesign of the incoming roadways. Particular concern is associated with designing the north leg of the roundabout to give drivers enough visual clues to reduce their speed prior to reaching the roundabout. The roundabout concept has not been dismissed and may be further developed if SDDOT decides to redesignate I-190 as an arterial street.

**TABLE 4-1: INTERSECTION LEVEL OF SERVICE (Projected 2030 Traffic)**

INTERSECTION	LEVEL OF SERVICE	
	AM	PM
US 16/SILVER ST./NORTH ST.	C	C

**Subtask 302: Present and review at-grade concepts.** Concepts were presented to SDDOT staff at a meeting held May 13, 2010 in Pierre. Meeting notes were prepared addressing the comments (Appendix) and the options were finalized for inclusion in this report.



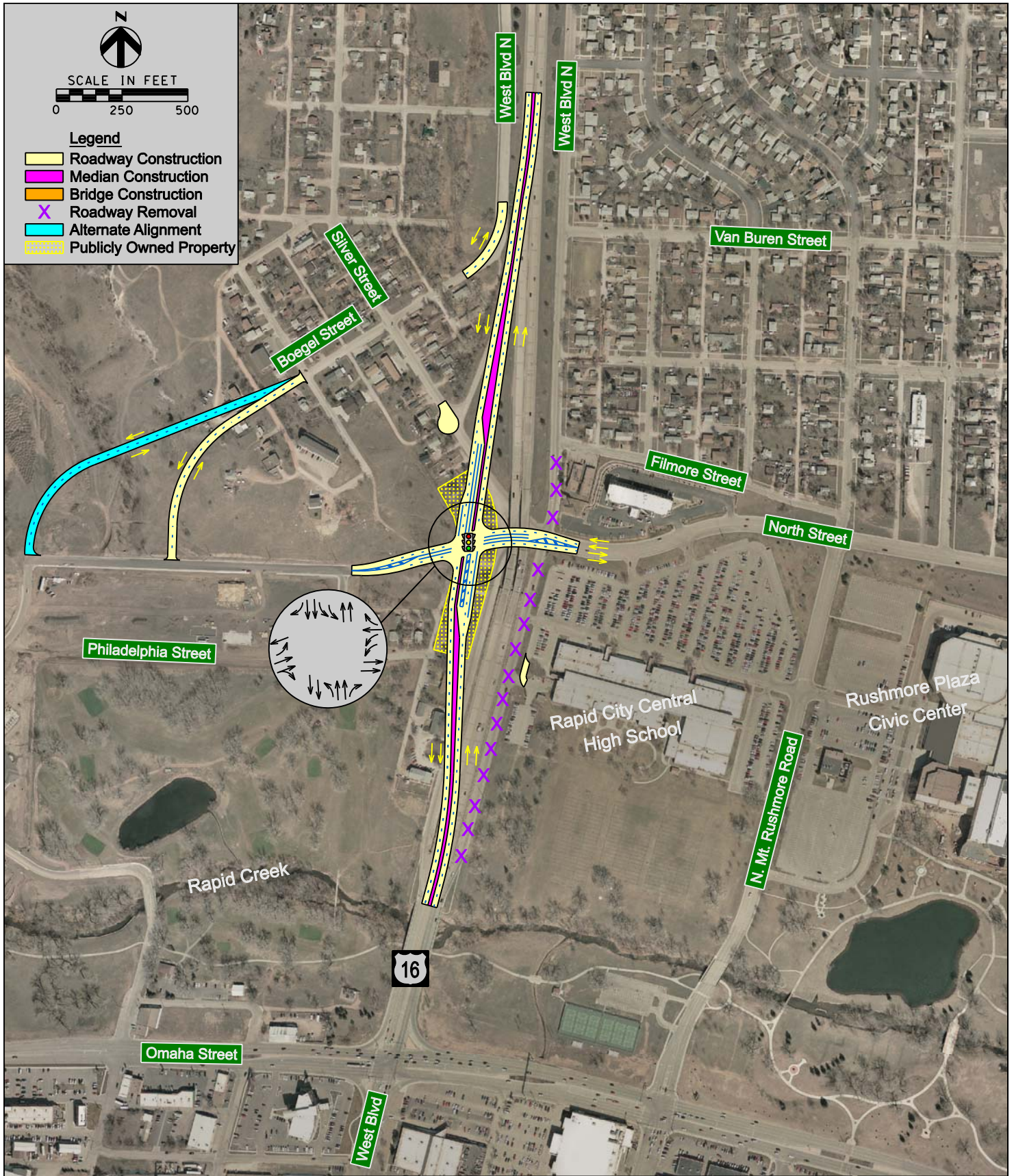
## Intersection Option 4

SD190 shifted west with at-grade intersection at  
Silver Street/North Street

Interstate 190/Silver Street Interchange Study  
Rapid City, South Dakota

June 28,  
2010





## Intersection Option 4a

SD190 shifted west with at-grade intersection at North Street

Interstate 190/Silver Street Interchange Study  
Rapid City, South Dakota

June 28,  
2010



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## Chapter 5 – Research Implications of Removing Interstate Designation

Converting Interstate 190 to some type of arterial roadway may make some sense from a technical viewpoint, but there are public policy and funding issues that need to be considered. In this chapter, research into those issues is presented, along with public comments solicited during the study.

**Background and General Information.** Interstate 190 (I-190) comprises 1.72 miles of the total 679 miles of interstates in South Dakota. I-190 therefore currently accounts for approximately 0.25% of South Dakota's Interstate highway miles and lane miles. In addition to the miles of interstate, I-190 comprises approximately 0.437% (11.2 million vehicle miles traveled) of the vehicle miles traveled (VMT) on the state's interstate system for fiscal year 2010.

De-designation of I-190 from the interstate system would lead to slight reductions in Federal Funds from the Interstate Maintenance (IM) Program assuming that future year funding formulas would be similar to 2009.

### **Subtask 401: Research funding and regulatory impacts.**

This subtask included research of funding and regulatory impacts associated with the removal of the interstate designation on I-190. The research included interviewing FHWA Division (Mark Hoines) and National office staff (Kevin Adderly – 202-366-5006).

HDR discussed the possible de-designation of I-190 and have received the following comments:

1. The ability to de-designate I-190 is available, but is not done frequently. A majority of interstate de-designations occurred during the 1960's and early 1970's.
2. A key issue may be management of the existing I-190 right-of-way (ROW). FHWA Division office staff have provided an opinion that repayment of previous Interstate funding would not be required if the route remains a public roadway. Any sale of the I-190 corridor ROW, however, would trigger a more detailed examination if the State intends to sell or distribute ROW acquired with Federal Funds for the purpose of development.
3. The FHWA Division office has provided guidance regarding preparation of a letter and packet of information to be forwarded to the FHWA National Office requesting de-designation.
4. The "packet" of information would be similar to that required for a proposed addition to the interstate system (i.e. interchange or overpass) and should include:
  - a. MPO resolution providing concurrence/support with the decision; and
  - b. Additional Local Government support would be well received.
5. AASHTO will also need to act to change the official route designation.

Interstate Maintenance (IM) Program:

The existing IM program provides funding for resurfacing, restoring, rehabilitating, and reconstructing (4R) for most routes on the Interstate System. Based on the current funding formula, South Dakota received \$43.8 million. (Note that South Dakota had 3% of funds transferred from their apportionments to the State's 402 Safety Program in compliance with



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Section 164 of Title 23- Minimum penalties for repeat offenders for Driving Under the Influence).

IM funds are apportioned to States based on the following:

- 33-1/3% based on **lane miles on Interstate System routes** open to traffic;
- 33-1/3% based on **total vehicle miles traveled (VMT) on Interstate System routes** open to traffic; and
- 33-1/3% based on State's annual contributions to the Highway Account of the Highway Trust Fund attributable to commercial vehicles.

Removing I-190 from the Interstate system would reduce IM funds by approximately 0.083% based on lane miles or approximately \$36,347, based on FY2009 authorization levels. De-designation will decrease VMT on interstate roadways by 0.437%, leading to an additional decrease in funds by 0.146%, or \$63,859, based on FY2009 authorization levels. The total per year decrease in IM funding, based on formula alone, would be approximately \$100,206 based on FY2009 authorizations.

South Dakota, however, currently is a minimum guarantee state, meaning that a floor has been established for overall Federal funding. Any difference in IM, NHS, or STP funding associated with redesignating I-190 would be offset by the Equity Bonus Program.

Funding impacts will potentially be felt, however, in the difference between the local match levels for IM (10%) and other programs (20%). The decrease in IM funding discussed above would only have a net impact to the State of South Dakota through the change in match levels of about \$13,900. Any future projects on the route would require double the state financial commitment if the designation is changed. In an era when South Dakota is already facing transportation funding challenges, the difference in funding match may be important.

Considering some example scenarios can help put the match issue into perspective:

- Scenario 1 – retain Interstate designation and build new Silver Street interchange, rough cost \$11.5 million, match \$1.15 million.
- Scenario 2- change route designation and build new Silver Street interchange, rough cost \$11.5 million, match \$2.3 million.
- Scenario 3 – change route designation and build new at-grade intersection, rough cost \$4 million, match \$0.8 million.

Judging solely based on cost impacts, Scenario 3 appears most favorable. Public input, however, seems to be favoring a rebuilt interchange at Silver Street (see discussion later in this memo). If an interchange is contemplated, retaining Interstate designation would be indicated. Cost will be considered as part of an overall decision matrix in the study report.

#### National Highway System (NHS) Program:

Currently, the 1.7 mile route is on the NHS as part of the Interstate system. The route would still be eligible for federal funding for non-Interstate routes and would be eligible for inclusion as a non-interstate NHS route connecting to a public transit facility. Such inclusion, however, may require other mileage to be removed from the NHS. A more detailed financial analysis is included in a memorandum by HDR economists, attached to the end of this report.

#### Information “Packet”:

Interstate access regulations indicate that removal of an interchange, such as the Silver Street interchange on I-190, is a reason for the analysis provided in an Interchange Justification Report (IJR). Such reports analyze existing and forecast operations in the vicinity of the interchange and



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provide the technical basis for an action decision in an Environmental Assessment (EA), or other environmental review. Since the study area for an IJR at the Silver Street interchange will likely include all of Interstate 190, it makes sense to analyze operations within the study area for this Phase 1 analysis to support the potential re-designation request and augment the analysis to produce an IJR. The decision-making process then becomes continuous and leads to the final action decision. The action that is the subject of the IJR must be evaluated in light of 8 conditions and requirements, as stated in federal regulations:

1. The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening storage) to satisfactorily accommodate the design-year traffic demands.
2. The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate without the proposed change(s) in access.
3. An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urban areas, include at least the first adjacent existing and proposed interchange on either side of the proposed change in access. The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, shall be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network. Requests for a proposed change in access must include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute and accommodate traffic on the interstate facility, ramps, intersection of ramps with crossroad, and local street network. Each request must also include a conceptual plan of the type and location of the signs proposed to support each design alternative.
4. The proposed access connects to a public road only and will provide for all traffic movements. Less than “full interchanges” may be considered on a case-by-case basis for applications requiring special access for managed lanes (e.g., transit, HOVs, HOT lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards.
5. The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving final approval, all requests for new or revised access must be included in an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan Transportation Improvement Program (STIP or TIP), and the Congestion Management Process within transportation management areas, as appropriate.
6. In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan.

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7. When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements. The request must describe the commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point.
  8. The proposal can be expected to be included as an alternative in the required environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing.

#### Future Transportation Funding Program Impacts:

Specifics of the potential impacts on I-190 posed by pending reauthorization of surface transportation legislation are largely unknown at this time. Congress is currently funding transportation expenditures through continuations of the previous transportation bill. Proposals for a new transportation bill have ranged widely, with the greatest concern centered on providing adequate, sustainable funding for transportation needs. Some items that appear in many of the proposals include:

- Consolidation or elimination of many current programs,
- Increased emphasis on safety, sustainability, and urban congestion,
- Use of performance standards, and
- Streamlining project delivery.

At this time there doesn't appear to be an impediment to re-designation of I-190 in the pending proposals.

HDR also conducted an inquiry among the transportation professionals in our offices and professional associations. We were able to find few records of any segment of existing roadway being removed from the Interstate highway system, a finding that was verified by Federal Highway Administration officials.

One useful source of historical information on the highway system is Wikipedia, where extensive documented descriptions have been assembled. Wikipedia shows a total of 67 instances where Interstate designations have been eliminated, but almost all have been due to renumbering of the Interstate system or cancellation of planned Interstate routes. The three notable exceptions are I-170, I-378 and I-480.

I-170 in Maryland was originally planned and partially built as part of the eastern terminus of the I-70 transcontinental route in the Baltimore area. The route was built to serve the Baltimore central business district, but I-70 was rerouted and the I-170 spur was eliminated from the Interstate system. It currently is designated as US 40.

A similar story underlies the fate of I-378. That route was built in the Bethlehem, PA area as part of the Interstate 78 system. When I-78 was rerouted, I-378 was changed to a state-jurisdiction freeway.

Perhaps the most well-known instance of elimination of an Interstate was I-480, or the Embarcadero Freeway in San Francisco, CA. The route was originally planned and partially built as a bayside freeway connection between the Oakland Bay Bridge and the Golden Gate Bridge. The constructed freeway section was heavily damaged in the Loma Prieta earthquake in 1989 and swelling public resistance caused the freeway section to be removed and the route returned to state-jurisdiction arterial street route.

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These examples are rare and random events and have resulted in no specific regulation or guidance on elimination of routes from the Interstate system. While such action is not specifically addressed in regulation or precedent, the guidance provided by the FHWA staff provides a clear path for action, should SDDOT decide to pursue re-designation of I-190.

**Subtask 402: Coordination with Rapid City MPO.** The study was introduced to the MPO committees at their regular April meetings. MPO committee members were also invited to a public meeting in May to view concepts for the future of the I-190/Silver Street interchange area and to discuss the ramifications of possibly changing I-190 from an Interstate highway to an expressway or arterial street.

**Subtask 403: Public Meeting.** A public meeting was held on May 27, 2010, to introduce and discuss re-designating I-190 and collect public input. Concept drawings for study area improvements were provided, along with a summary of funding and regulatory impact research. Copies of the completed comment cards from the public meeting are included in the Appendix of this report. Some notable comments include:

- Those expressing a preference for one of the options favored Option 2a, a single-point interchange with a realigned cross-street. Option 4a, an at-grade intersection with a realigned cross-street also was viewed favorably, but not as favorably as Option 2a.
- A number of comments requested that the existing I-190 route be curved to the east to connect to Mt. Rushmore Road at Omaha Street, an action that may conflict with plans for Central High and with existing parks and floodways.
- Attention was drawn to providing good handling of events at the Civic Center and Central High.
- The school district objected to any plans that would cut off existing connections between the northbound off ramp at Silver Street and Central High parking lots. A subsequent meeting showed that School District concerns may be mitigated by providing adequate buffer space between the highway and Central parking lots, and by providing a revised connecting driveway between parking lots that allows use of parking areas as currently planned.

**Subtask 404: Prepare Technical Memo.** A technical memo was prepared to document the work done during this Task 400. Attachments to the memo included a pro-con list related to the re-designation decision and a digest of comments received from the MPO committees and public (Appendix).

**TABLE 5-1: PRO-CON LIST**  
**I-190 CONVERSION DECISION**

PRO - REASONS TO REDESIGNATE	CON - REASONS NOT TO REDESIGNATE
1. <u>CLARITY</u> - REDESIGNATION WOULD HELP CLARIFY EXISTING DEAD-END INTERSTATE ROUTE	1. <u>COST</u> - SMALL POTENTIAL EFFECT ON OVERALL FEDERAL REIMBURSEMENT, SWITCHING OF FUND SOURCE
2. <u>STANDARDIZATION</u> - REDESIGNATION WOULD FIX HIGHWAY THAT DOESN'T MEET DESIGN STANDARDS	2. <u>RECOGNITION</u> - NO LONGER INTERSTATE SERVICE TO CITY CENTER
3. <u>CONNECTIVITY</u> - REDESIGNATION COULD ALLOW CORRIDOR TO HAVE BETTER CONNECTIVITY AND PLAY A GREATER ROLE IN CIRCULATION	3. <u>DELAY</u> - SOME TRIPS MAY BE SLIGHTLY LONGER
4. <u>BEAUTIFICATION</u> - REDESIGNATION COULD ALLOW MORE ROOM FOR LANDSCAPING, AMENITIES	4. <u>CAPACITY</u> - UNUSED CAPACITY MAY BE NEEDED IN THE FUTURE
5. <u>SAFETY</u> - REDESIGNATION COULD ALLOW ELIMINATION OF LIFE-LIMITED BRIDGES, NON-STANDARD DESIGN	
6. <u>CAPACITY</u> - CURRENT UNDER-USED ROUTE COULD BE REPURPOSED FOR BICYCLES, PEDESTRIANS, OTHER TRANSPORTATION USES	
7. <u>COST</u> - POSSIBLE ELIMINATION OF BRIDGE COSTS	
8. <u>ENVIRONMENT</u> - REDESIGNATION AND CHANGE TO AN ARTERIAL ROUTE COULD PRODUCE LESS NOISE AND HAVE REDUCED ENVIRONMENTAL IMPACTS	

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## Chapter 6 – Decision Support

In addition to the information developed in the preceding chapters, environmental considerations and cost estimates were also examined to provide a basis for SDDOT's decision on whether to change the designation of I-190. The environmental and cost information is summarized in the following sections, followed by an evaluation matrix and decision recommendation.

### Environmental Considerations

A preliminary screening of environmental considerations was conducted related to:

- 1) Removing the Interstate system designation from I-190, and
- 2) Potential impacts of the preliminary interchange and intersection options.

There is little in the environmental screening to shed light on the designation decision. An initial analysis indicates that the constructed Interchange/Intersection Options that would be non-Interstate, specifically Option 4 and Option 4a would have a reduced footprint versus the other Options. The reduced footprint would require less relocations and acquisitions. The number of relocations is preliminary and subject to change as design is refined and the area is further analyzed. Also as non-Interstate, the roadway would be regulated at lower speeds versus an Interstate roadway. Therefore, noise would be reduced in this primarily residential area.

Environmental considerations related to the preliminary interchange and intersection options are summarized in Table 6-1. The complete environmental memorandum has been provided in the Appendix.

### Cost Estimates

Preliminary cost estimates for the interchange and intersection options were developed and are summarized in Table 6-2. The estimates indicate that Option 2a is the most cost effective interchange option, while Options 4 and 4a provide intersection options at considerable savings compared to interchanges. The individual cost estimates have been provided in the Appendix.

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**Table 6-1 Summary of Environmental Issues for Options**

<b>Resources</b>	<b>Summary of Options Impacts</b>
<b>Air Quality</b>	No significant impact for all Options.
<b>Water Quality</b>	To be considered further during EA Process.
<b>Public Facilities and Services</b>	To be considered further during EA Process.
<b>Recreational Resources</b>	All Interstate Options have potential to encroach on Executive Golf Course and Greenway. Option 3b may also encroach on Memorial Park West.
<b>Visual Impacts and Aesthetics</b>	No significant impact for all Interstate Options.
<b>Environmental Justice</b>	To be considered further during EA Process.
<b>Noise</b>	To be considered further during EA Process.
<b>Threatened and Endangered Species</b>	To be considered further during EA Process.
<b>Invasive Species</b>	No significant impact for all Interstate Options.
<b>Archeological and Historic Resources</b>	Records search and intensive archeological and historic properties to be conducted.
<b>Section 4(f) and 6(f) Resources</b>	All Options have potential to encroach on Executive Golf Course and Greenway. Option 3b may also encroach on Memorial Park West.  Section 6(f) resources will need to be identified during EA process.
<b>Regulated Materials</b>	To be considered further during EA Process.
<b>Land Use</b>	No significant impact for all Interchange Options.
<b>Farmland</b>	No significant impact for all Interchange Options.
<b>Floodplains</b>	To be considered further during EA Process.
<b>Economic Resources</b>	To be considered further during EA Process.
<b>Relocations</b>	See Table 2; To be considered further during EA Process.
<b>Wetlands and Other Waters of the US</b>	To be considered further during EA Process.
<b>Construction</b>	To be considered further during EA Process.
<b>Indirect and Cumulative Impacts</b>	To be considered further during EA Process.



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**Table 6-2 Preliminary Design Option Cost Estimate Summary**

OPTION	COST ESTIMATE
Option 1	\$13,363,657.50
Option 1a	\$13,526,715.00
Option 2	\$13,317,937.50
Option 2a	\$12,100,830.00
Option 2 hybrid	\$13,061,937.50
Option 3	\$14,828,190.00
Option 3a	\$14,960,990.00
Option 3b	\$15,411,035.00
Option 4	\$7,161,000.00
Option 4a	\$7,137,000.00

### Evaluation Matrix

An evaluation matrix (**Table 6-3**) was prepared based on criteria and weighting factors suggested by SDDOT. The matrix is a tool for ranking the factors leading to a decision about whether to change the designation of I-190 and adding some objectivity to the decision. The matrix contains composite rankings provided by SDDOT staff that has worked on the Phase 1 study. Each criteria was ranked from 0 (alternative offers nothing to meeting criteria) to 1 (alternative fully meets criteria).

The overall ranking of the two alternatives are quite close to each other, with the alternative to remove the Interstate designation receiving the higher ranking. Differences in individual interpretation can play a role in the ranking outcome and having a larger sample size would provide greater statistical confidence.

**Table 6-3 Evaluation Matrix**

EVALUATION CRITERIA	WEIGHT	COURSE OF ACTION	
		RETAIN INTERSTATE DESIGNATION	REMOVE INTERSTATE DESIGNATION
MEETS DESIGN STANDARDS	0.08	0.840	0.960
PROPERTY IMPACTS	0.08	0.320	0.720
UTILITY IMPACTS	0.08	0.480	0.680
ENVIRONMENTAL IMPACTS	0.11	0.580	0.700
DEVELOPMENT IMPACTS	0.08	0.440	0.700
COST	0.11	0.380	0.740
TRAFFIC OPERATIONS	0.11	0.860	0.600
SAFETY	0.11	0.740	0.520
PUBLIC PERCEPTION	0.08	0.720	0.580
REGULATORY/FUNDING IMPACTS	0.08	0.880	0.700
COMPLIES WITH TRANSPORTATION PLANS	0.08	0.620	0.660
TOTAL	1.00		
<b>RATING</b>		<b>0.626</b>	<b>0.682</b>

## Initial Findings

The results of the public input show that a new single point interchange at the location of the current Silver St. interchange would find higher public acceptance than the other options developed to date. The public comments also indicated interest in considering connecting I-190 with Mt. Rushmore Road at Omaha Street. These concepts and the other developed options should move into the Environmental Assessment process as soon as a decision is made regarding the designation of I-190.

Input from the Rapid City School District and Central High officials reveals concern about changes in the existing circulation patterns around the school. Many of these concerns could be mitigated by moving the I-190 alignment west (as shown in many of the concept layouts), providing some buffer space between the roadway and the school, and providing a revised connection between the school parking lots that facilitates planned parking arrangements.

SDDOT's evaluation of the decision criteria shows that there was mixed feelings about removing the Interstate designation of I-190. Although initial opinion tended slightly toward removing the Interstate designation, the matrix did not provide support for a clear decision. Details of those design features will be addressed during the environmental and regulatory review process.

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## **Addendum – Additional Analysis**

Following delivery of the first six chapters of this report, SDDOT requested analysis of additional design options, including a connection north from the existing system interchange at I-90/I-190. The added work was documented in a technical memorandum, which is reproduced in the following pages. Some additional layouts have also been added to the Appendix for reference.

### **Additional Findings**

Feasible alternatives that include revision of the existing I-90/I-190 system interchange to a service interchange with a connection to the local street system north of I-90 were developed as part of the additional analysis. The estimated costs of these alternatives ranged from approximately \$7.4 million to \$8.7 million.

Following discussions with the City of Rapid City regarding transportation plans and funding, SDDOT decided to retain the Interstate designation on I-190 and proceed to produce an Environmental Assessment and Interchange Justification Report for a revised interchange on I-190 at Silver Street.

To: Steve Gramm	
From: HDR	Project: I-190 Study Phase 1 Amendment
CC:	
Date: 12/10/2010	Job No:

**RE: Additional analysis**

This technical memorandum documents the additional analysis authorized under work order PD-02-09, agreement 410445. The work is presented to correspond with the task items in the amendment scope of services and is intended to facilitate discussion and decision-making.

**Task 1: Data Gathering**

Travel time runs were conducted on four routes to help validate forecast model output and provide a basis for mobility analysis. The four routes are:

- I-190, Omaha Street to I-90
- Omaha Street, I-190 to 5<sup>th</sup> Street
- Haines Avenue/5<sup>th</sup> Street, Omaha Street to Disk Drive
- I-90, from Exit 55 (Deadwood Ave.) to Exit 58 (Haines Ave.)

Travel time data is summarized in Table 1.

**TABLE 1 - TRAVEL TIME SUMMARY**

ROUTE	DIRECTION	TIME PERIOD	AVERAGE TRAVEL TIME (MINUTES:SECONDS)	AVERAGE SPEED (MPH)
I-190	NB	AM	2:27	50.4
	SB	AM	2:11	50.8
	NB	PM	2:24	51.5
	SB	PM	2:08	52.1
OMAHA ST.	EB	AM	1:04	27.4
	WB	AM	1:25	20.6
	EB	PM	1:19	22.2
	WB	PM	1:45	16.8
HAINES/5TH	NB	AM	3:45	31.8
	SB	AM	5:10	23.1
	NB	PM	4:51	24.6
	SB	PM	5:46	20.7
I-90	EB	AM	2:42	67.3
	WB	AM	2:50	64.5
	EB	PM	2:41	67.7
	WB	PM	2:51	64.2

## Task 2: Traffic Forecasting

Traffic was forecasted for 2035 conditions, using output from the regional model provided by the City of Rapid City. Additional mobility statistics were also supplied from regional model output. The forecasts were prepared for four alternatives:

- Alternative 1: I-190/US-16 route with interchange at Silver Street
- Alternative 2: US-16 route with interchange at Silver Street and connection to Mall Drive
- Alternative 3: US-16 route with at-grade intersection at Silver Street
- Alternative 4: US-16 route with at-grade intersection at Silver Street and connection to Mall Drive

Forecast link volumes for the AM and PM peak periods are shown in Figures 1 through 8.

## Task 3: Analyze Operations

Operations analysis was conducted for the four forecast scenarios under 2035 AM and PM peak traffic conditions. The results of the interstate operations analysis are shown in Tables 2 and 3. The results of the surface streets operations analysis are shown in Figures 9 through 16.

**TABLE 2 - INTERSTATE MAINLINE LEVEL OF SERVICE (2035)**

ROUTE	FROM	TO	ALT. 1		ALT. 2		ALT. 3		ALT. 4	
			A M	P M	A M	P M	A M	P M	A M	P M
I-190 NB	OMAHA ST.	SILVER OFF	B	B						
	SILVER OFF	SILVER ON	B	B						
	SILVER ON	I-90	B	B						
I-190 SB	I-90	SILVER OFF	B	B						
	SILVER OFF	SILVER ON	A	B						
	SILVER ST.	OMAHA ST.	B	B						
I-90 EB	DEADWOOD ON	I-190 OFF	C	C	C	C	C	C	C	C
	I-190 OFF	I-190 ON	B	C	B	C	B	C	B	C
	I-190 ON	HAINES OFF	B	C	B	C	B	C	B	C
	HAINES OFF	HAINES ON	C	C	C	C	C	C	C	C
	HAINES ON	LACROSSE OFF	C	C	C	C	C	C	C	C
I-90 WB	LACROSSE ON	HAINES OFF	C	C	C	C	C	C	C	C
	HAINES OFF	HAINES ON	C	C	C	C	C	C	C	C
	HAINES ON	I-190 OFF	B	B	B	B	B	B	B	B
	I-190 OFF	I-190 ON	B	C	B	C	B	C	B	C
	I-190 ON	DEADWOOD OFF	C	C	C	C	C	C	C	C

The intersection of Haines Avenue/Disk Drive is of particular concern due to the potential for increased trips through the intersection with a new connection between I-190/US 16 and Disk Drive. While there are additional trips through the intersection under all four future scenarios, many of the trips associated with a new Disk Drive connection pass through the Haines Avenue/Disk Drive intersection as through trips. Analysis indicates that the intersection will continue to operate acceptably with the existing lane configuration. See Figures 9-16 for intersection traffic volumes and levels of service.

The I-190-US 16/Omaha intersection operates of level of service D under some future scenarios. Analysis indicates and adding a through lane to the north and south approaches will bring the level of service to C.

**TABLE 3 - INTERSTATE RAMP LEVEL OF SERVICE (2035)**

ROUTE	RAMP	ALT. 1		ALT. 2		ALT. 3		ALT. 4	
		AM	PM	AM	PM	AM	PM	AM	PM
I-190	NB SILVER OFF	A	A	A	A				
	NB SILVER ON	A	A	A	A				
	NB I-190 OFF	A	A	A	A				
	SB I-190 ON	A	A						
	SB SILVER OFF	A	A						
	SB SILVER ON	A	B	A	B				
I-90	EB I-190 OFF	B	C	B	C	B	C	B	C
	EB I-190 ON	B	C	C	C	B	C	C	C
	EB HAINES OFF	B	C	B	C	B	C	B	C
	EB HAINES ON	B	C	B	C	B	C	B	C
	WB HAINES OFF	B	B	B	B	B	B	B	B
	WB HAINES ON	C	C	C	C	C	C	C	C
	WB I-190 OFF	A	A	B	C	A	A	B	C
	WB I-190 ON	A	A	B	B	A	A	B	B
	WB I-190 TO HAINES WEAVE	C	D	C	D	C	D	C	D

#### Task 4: Estimate Mobility

Summary statistics from the regional traffic forecasting model were examined to determine which of the alternatives may provide the best overall mobility. The model-produced statistics were adjusted to produce an estimated comparison of total network delay, shown in Table 4. The comparison shows that the alternative with an interchange at Silver Street and a connection to Disk Drive provides the lowest overall delay. It should be noted, however, that the variance between the results of the four alternatives is less than 1%, a small difference that may not be significant in relation to the precision possible in traffic forecasting.

Future travel times were also estimated for various routes through the study area under each scenario. The travel times are shown in Table 5.



**TABLE 4 - TOTAL NETWORK DELAY ESTIMATE**

<b>SCENARIO</b>	<b>TOTAL NETWORK DELAY (HOURS)</b>
SILVER ST. INTERCHANGE	13,083
SILVER ST. INTERCHANGE WITH DISK DRIVE CONNECTION	12,999
SILVER ST. INTERSECTION	13,075
SILVER ST. INTERSECTION WITH DISK DRIVE CONNECTION	13,004

**TABLE 5 - TRAVEL TIME COMPARISON**  
ESTIMATED 2035 PM TRAVEL TIMES

SCENARIO				TRAVEL TIME PER SYSTEM		
ORIGIN	DESTINATION	ROUTE	SILVER STREET	INTERCHANGE OPTION (MINUTES)		
				NO BUILD	OPTION 3C	OPTION 6
OMAHA ST. & WEST BLVD.	HAINES AVE. & DISK DR.	I-190/US 16 TO I-90 TO HAINES AVE. TO DISK DR.	INTERCHANGE	3.40	N/A	N/A
OMAHA ST. & WEST BLVD.	HAINES AVE. & DISK DR.	I-190/US 16 TO I-90 TO HAINES AVE. TO DISK DR.	INTERSECTION	3.95	4.06	5.24
OMAHA ST. & WEST BLVD.	HAINES AVE. & DISK DR.	I-190/US 16 TO DISK DR. TO HAINES AVE.	INTERSECTION	N/A	3.43	3.48
OMAHA ST. & WEST BLVD.	I-90 @ DEADWOOD AVE.	I-190/US 16 TO I-90 TO DEADWOOD AVE.	INTERCHANGE	4.19	N/A	N/A
OMAHA ST. & WEST BLVD.	I-90 @ DEADWOOD AVE.	I-190/US 16 TO I-90 TO DEADWOOD AVE.	INTERSECTION	4.74	5.23	5.29
HAINES AVE. & DISK DR.	OMAHA ST. & WEST BLVD.	HAINES AVE. TO I-90 TO I-190/US 16 TO OMAHA ST.	INTERCHANGE	3.26	N/A	N/A
HAINES AVE. & DISK DR.	OMAHA ST. & WEST BLVD.	HAINES AVE. TO I-90 TO I-190/US 16 TO OMAHA ST.	INTERSECTION	3.55	3.79	4.16
HAINES AVE. & DISK DR.	OMAHA ST. & WEST BLVD.	DISK DR. TO I-190/US 16 TO OMAHA ST.	INTERSECTION	N/A	5.53	5.90
I-90 @ DEADWOOD AVE.	OMAHA ST. & WEST BLVD.	I-90 TO I-190/US 16 TO OMAHA ST.	INTERCHANGE	3.77	N/A	N/A
I-90 @ DEADWOOD AVE.	OMAHA ST. & WEST BLVD.	I-90 TO I-190/US 16 TO OMAHA ST.	INTERSECTION	4.06	4.65	4.29
I-90 @ DEADWOOD AVE.	HAINES AVE. & DISK DR.	I-90 TO HAINES AVE. TO DISK DR.	INTERCHANGE	3.86	N/A	N/A
I-90 @ DEADWOOD AVE.	HAINES AVE. & DISK DR.	I-90 TO HAINES AVE. TO DISK DR.	INTERSECTION	3.86	3.86	3.86
I-90 @ DEADWOOD AVE.	HAINES AVE. & DISK DR.	I-90 TO I-190/US 16 TO DISK DR. TO HAINES AVE.	INTERSECTION	N/A	4.47	4.00
HAINES AVE. & DISK DR.	I-90 @ DEADWOOD AVE.	HAINES AVE. TO I-90 TO DEADWOOD AVE.	INTERCHANGE	3.10	N/A	N/A
HAINES AVE. & DISK DR.	I-90 @ DEADWOOD AVE.	HAINES AVE. TO I-90 TO DEADWOOD AVE.	INTERSECTION	3.10	3.10	3.10
HAINES AVE. & DISK DR.	I-90 @ DEADWOOD AVE.	DISK DR. TO I-190/US 16 TO I-90 TO DEADWOOD AVE.	INTERSECTION	N/A	3.49	3.49

## **Task 5: Develop Concept Drawing/Estimate**

Two concept drawings were created for conversion of the I-90/I-190 system interchange into a full-movement service interchange. The first concept involves converting the existing I-90/I-190 interchange into a service interchange with one loop quadrant. The second concept is similar to the first, but includes a second loop quadrant. The concept drawings are shown in Figures 17 and 18.

Planning-level cost estimates were prepared for each of the concepts. The estimates are provided in Figures 19 and 20.



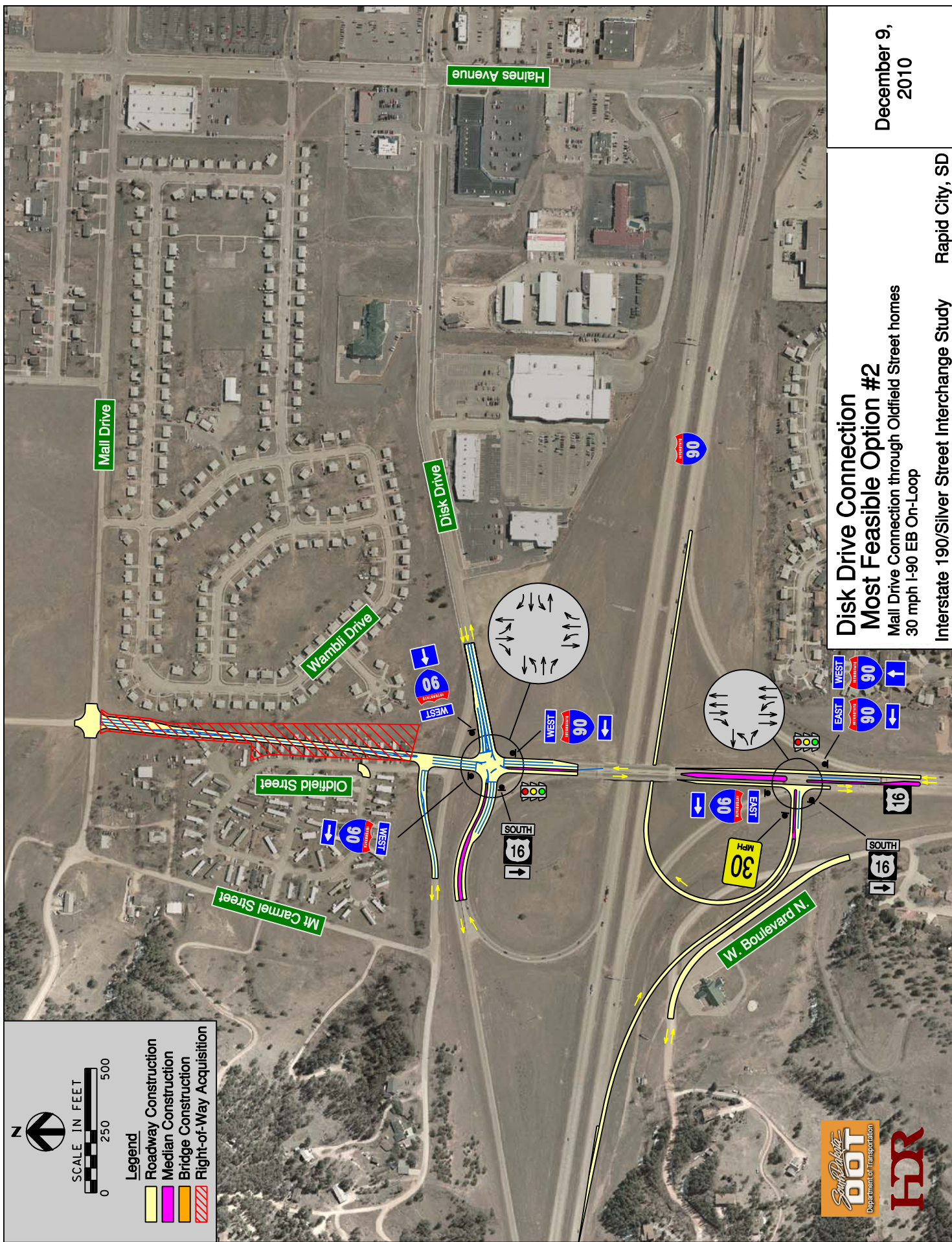
**Disk Drive Connection  
Most Feasible Option #1**  
Mail Drive Connection through Oldfield Street homes

December 9,  
2010

Interstate 190/Silver Street Interchange Study      Rapid City, SD





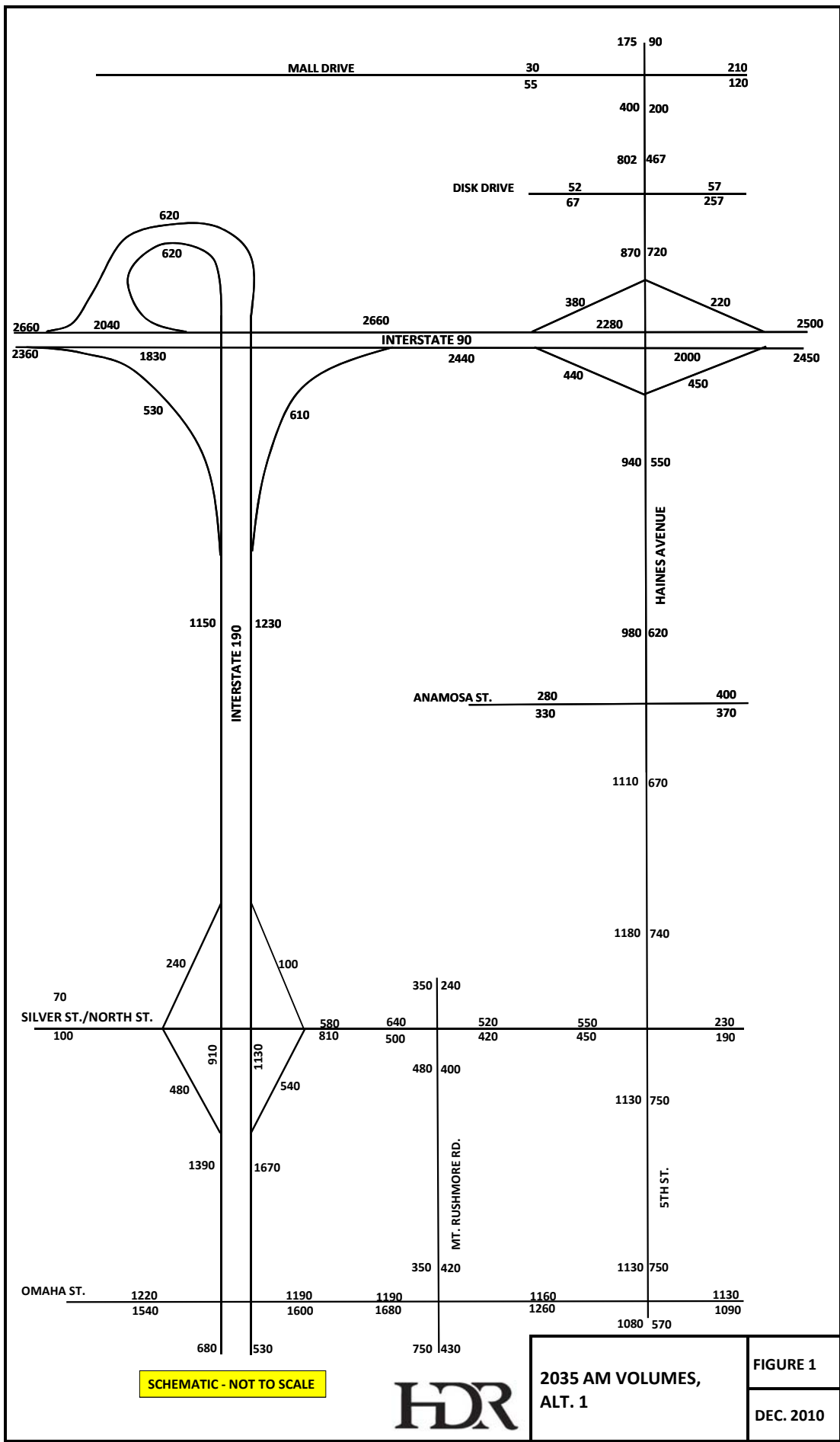


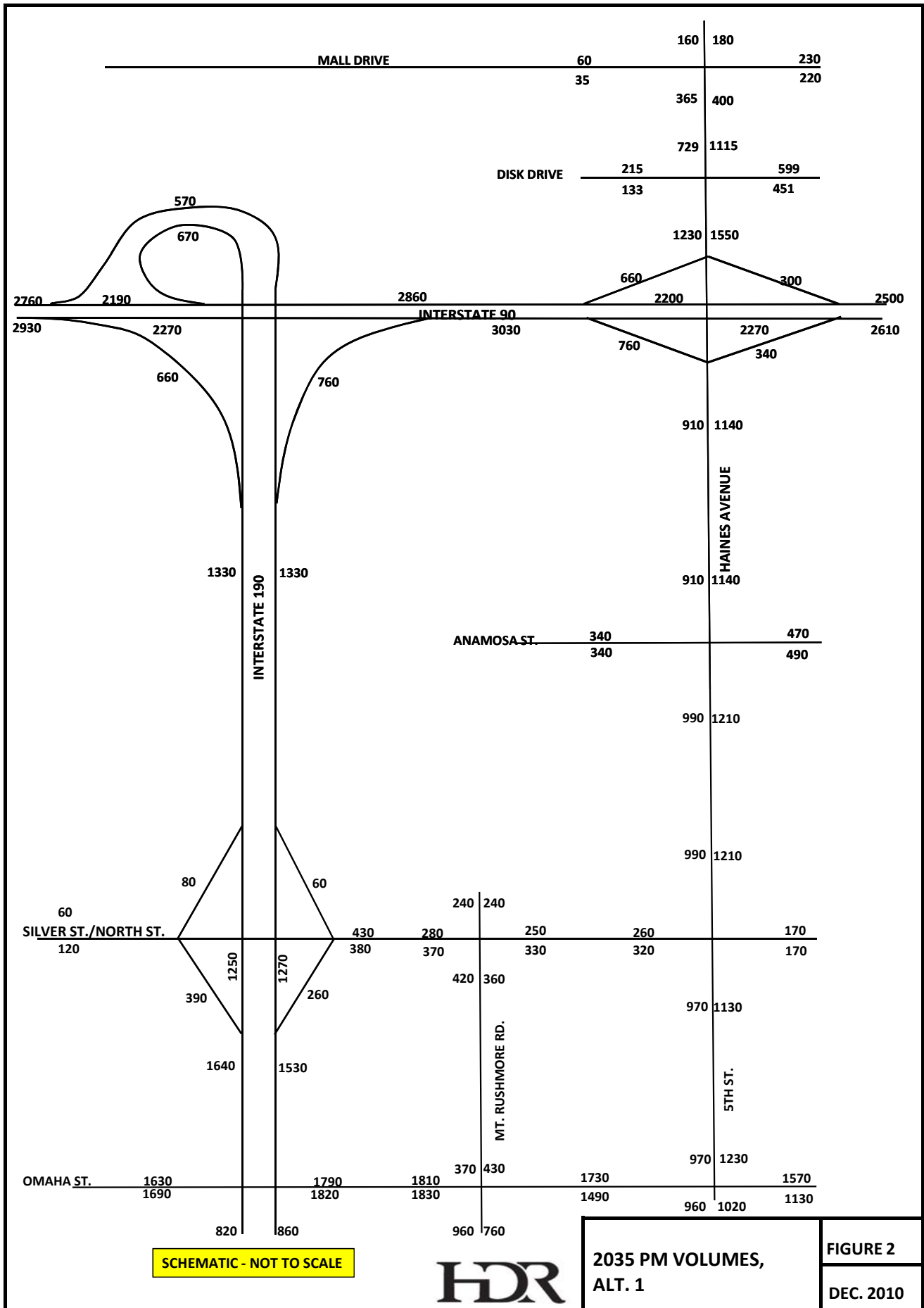
December 9,  
2010

**Disk Drive Connection  
Most Feasible Option #2**  
Mail Drive Connection through Oldfield Street homes  
30 mph I-90 EB On-Loop

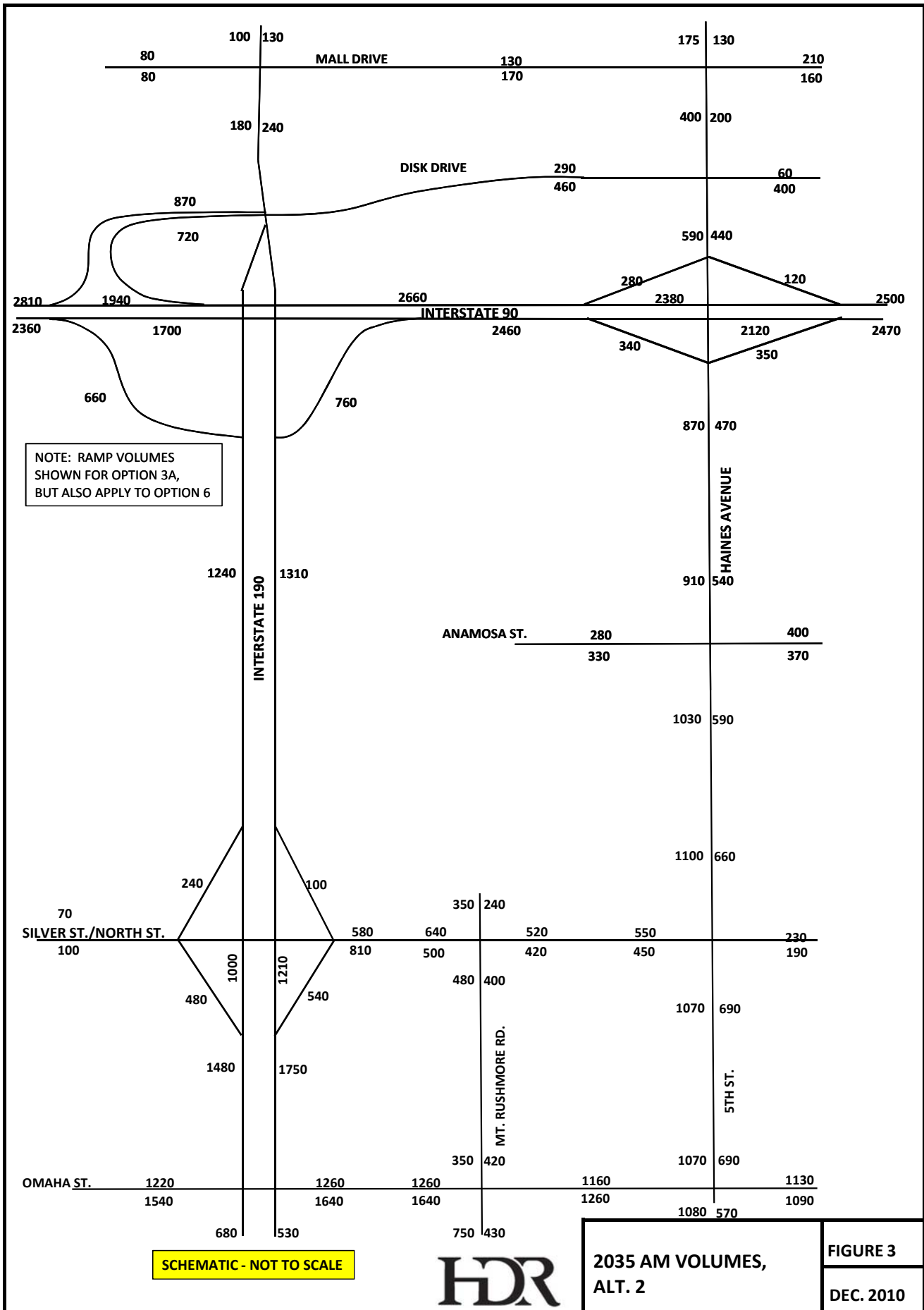
Interstate 190/Silver Street Interchange Study      Rapid City, SD



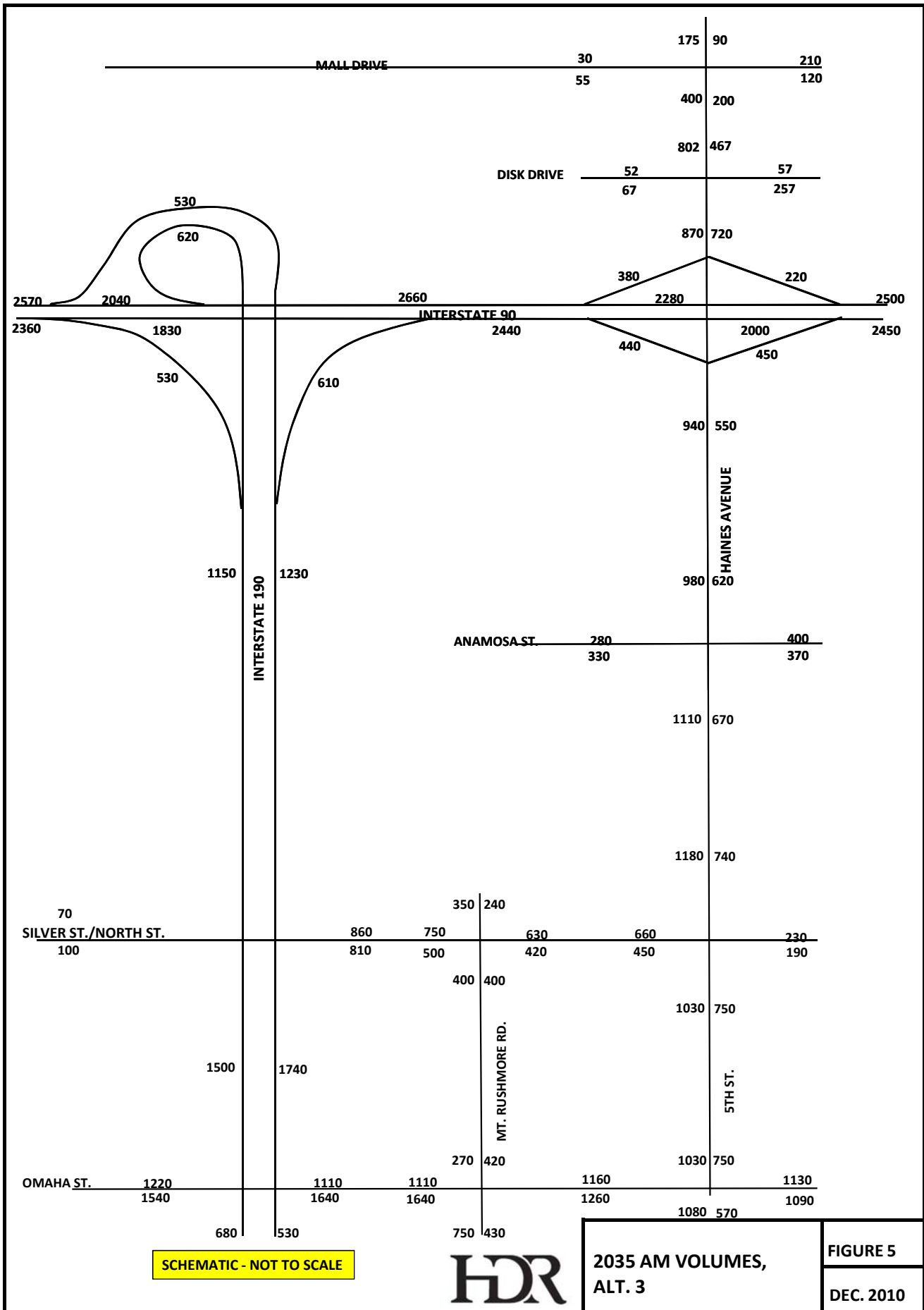


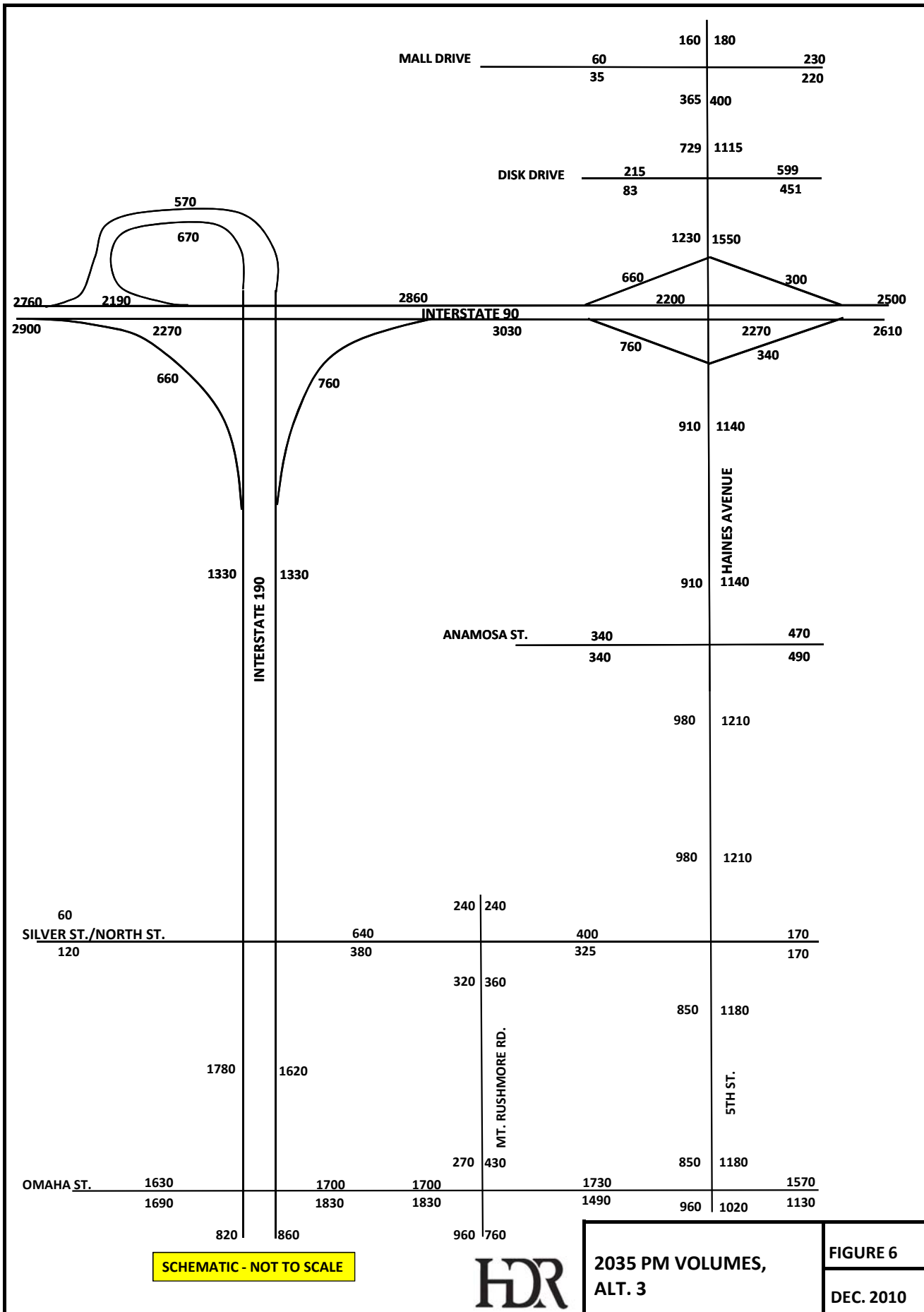


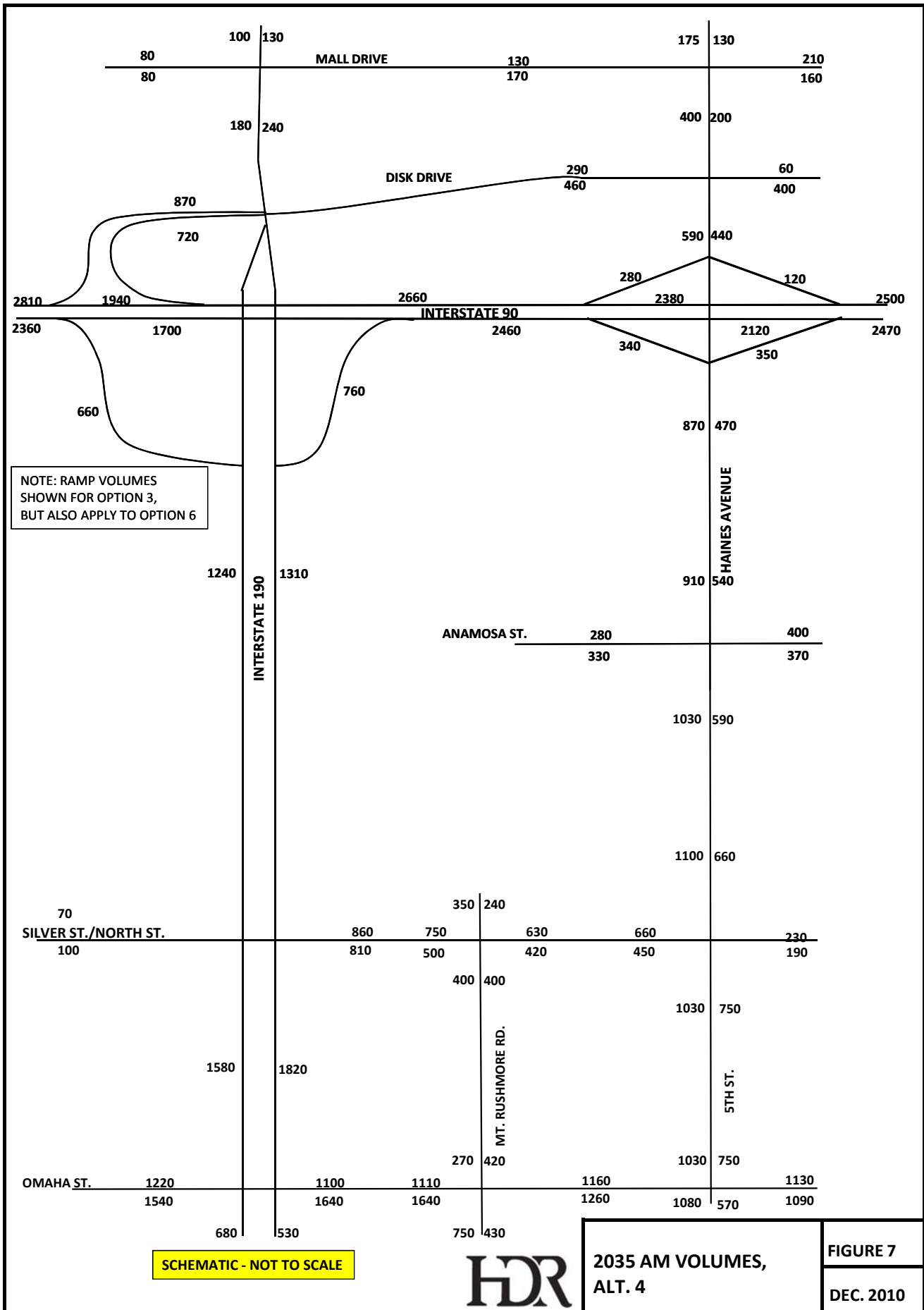


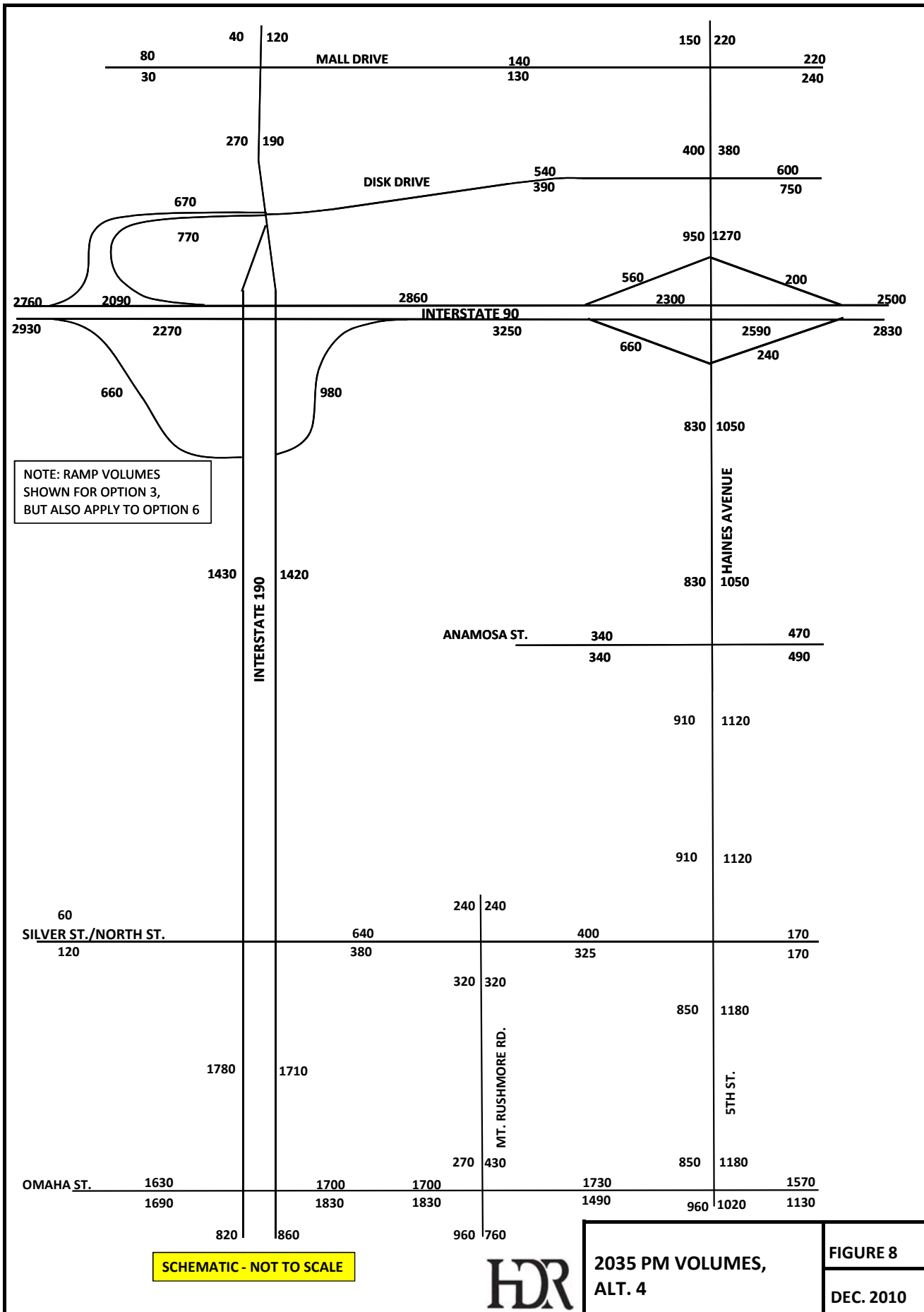














**FIGURE 8**  
**DEC. 2010**

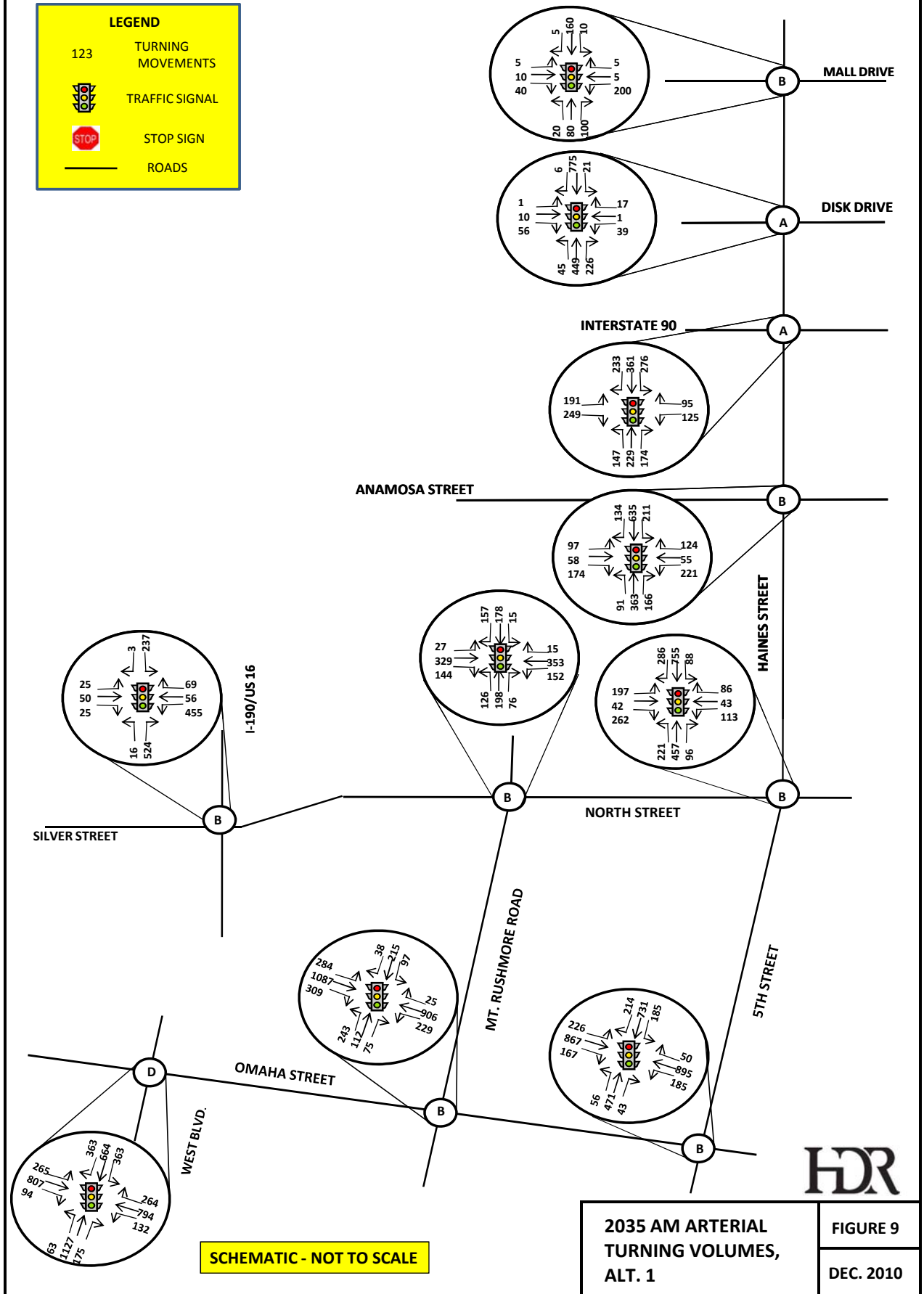
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123      TURNING MOVEMENTS

      TRAFFIC SIGNAL

      STOP SIGN


—      ROADS







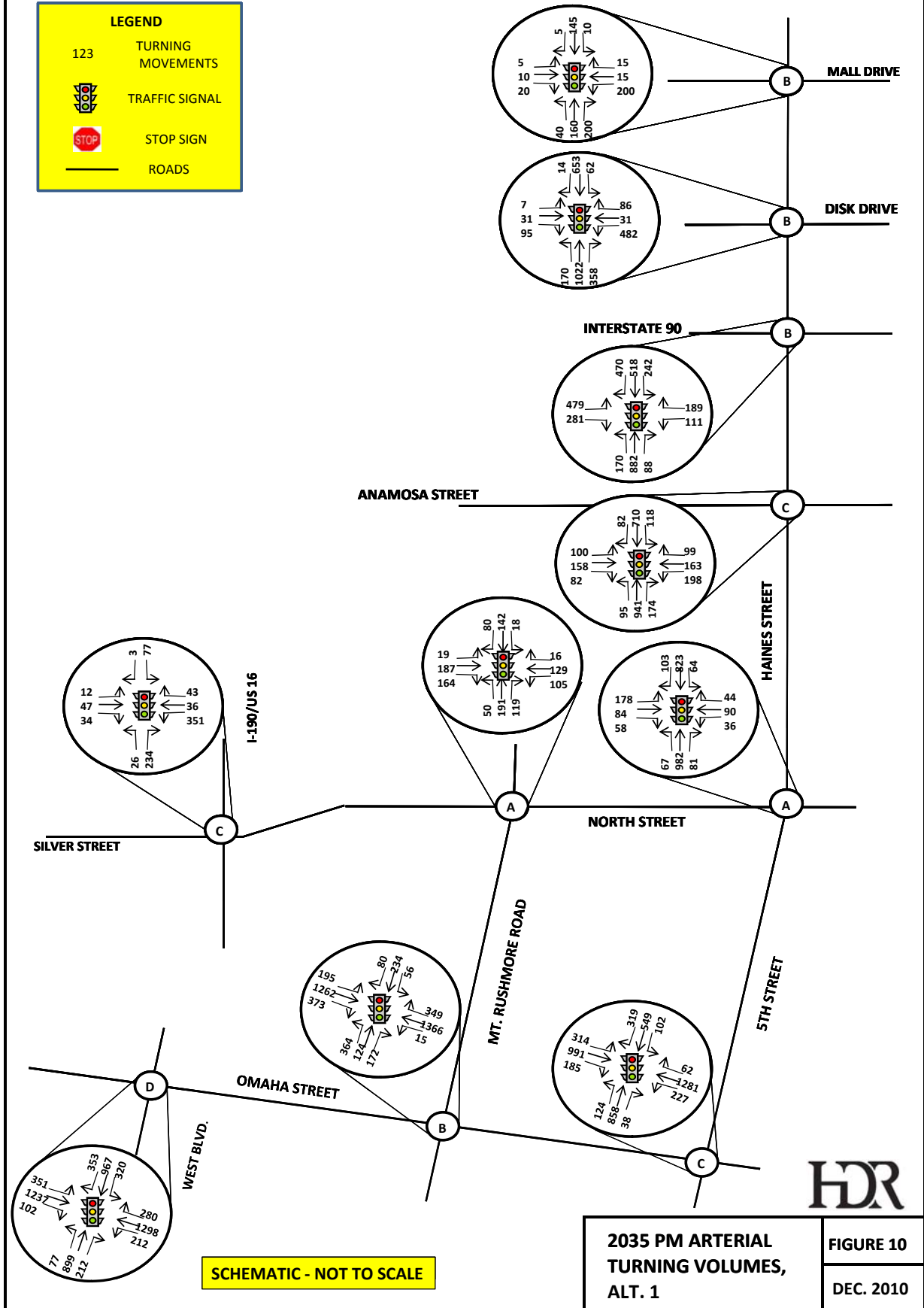
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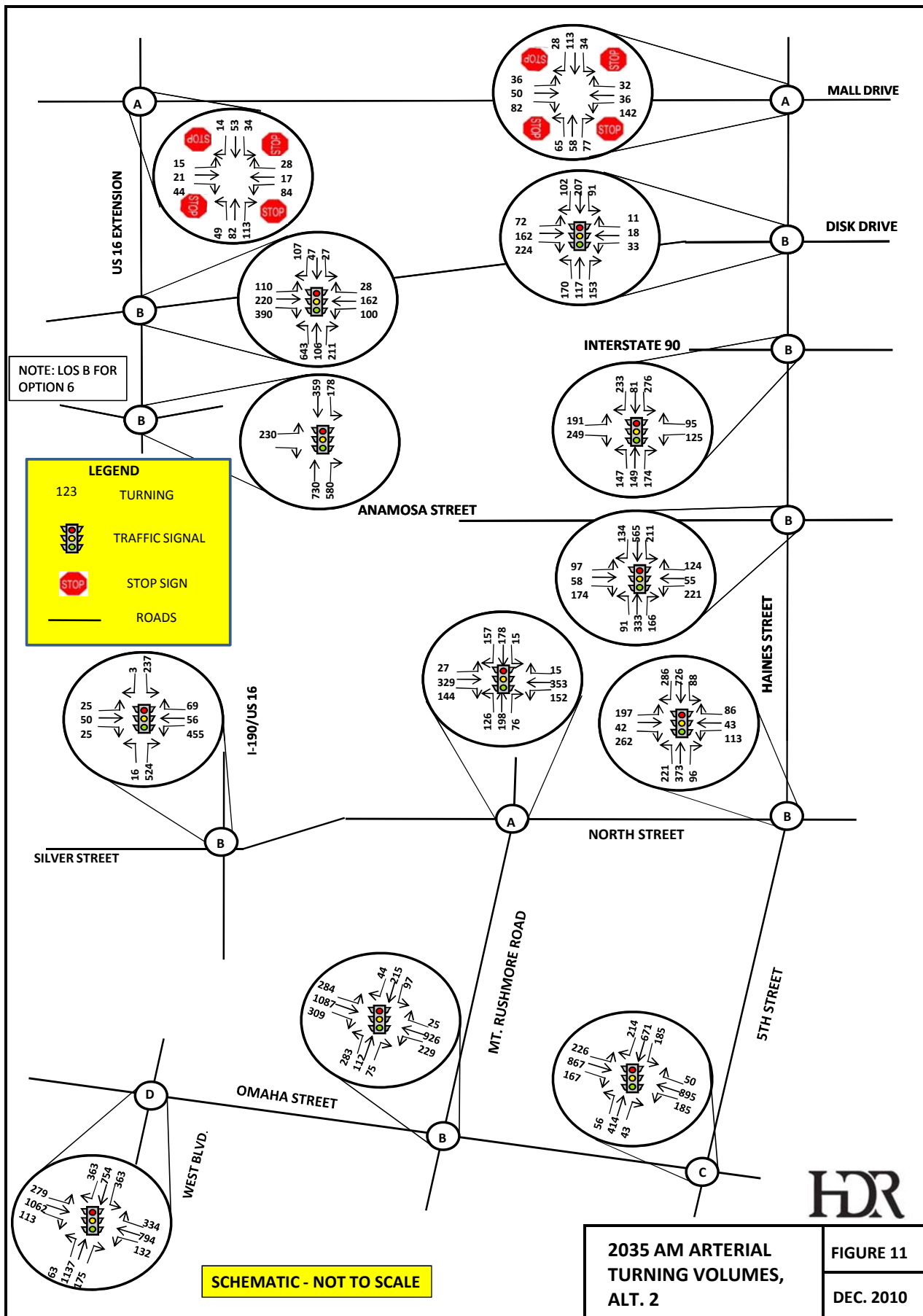
123 TURNING MOVEMENTS

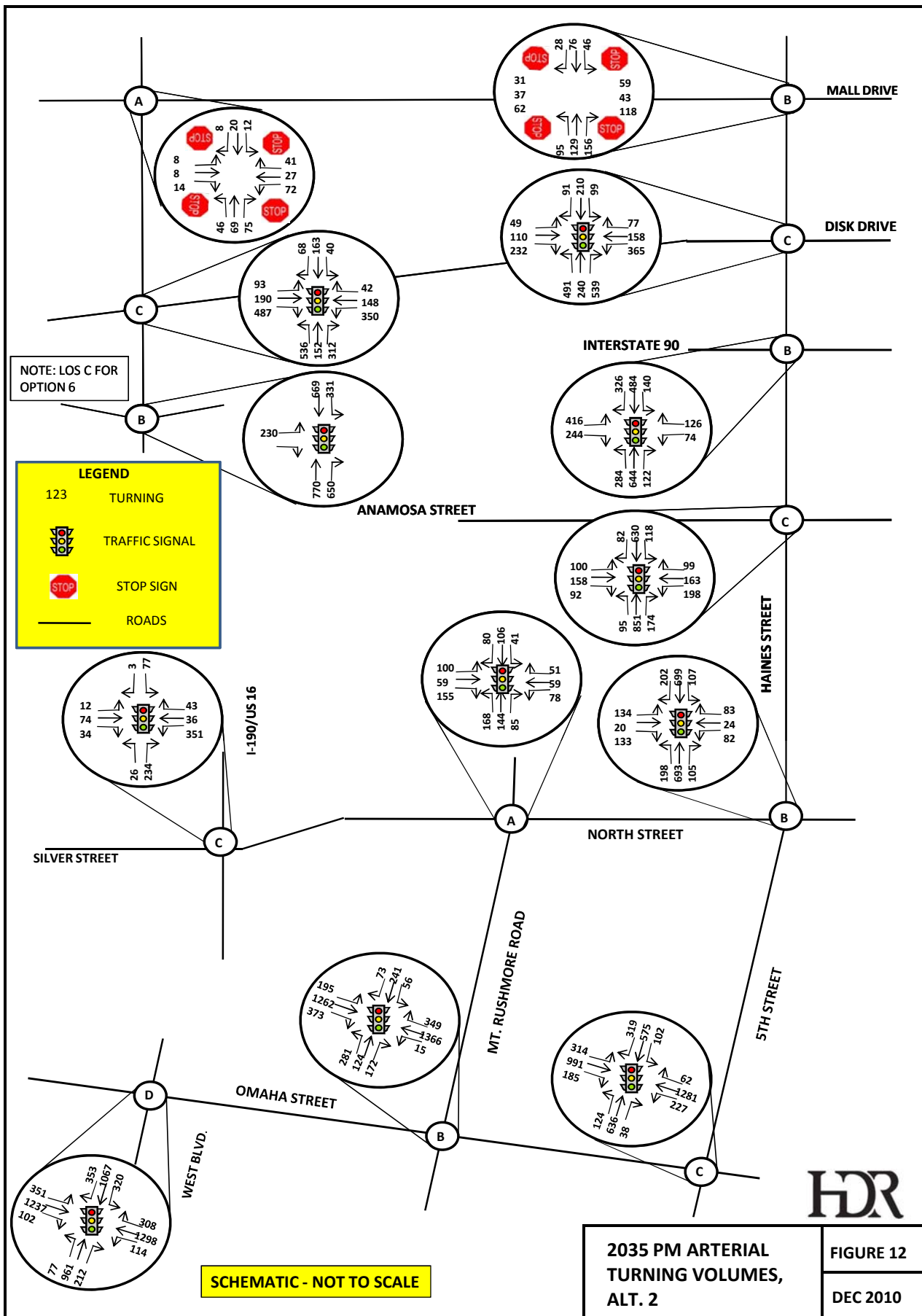
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 STOP SIGN

 ROADS









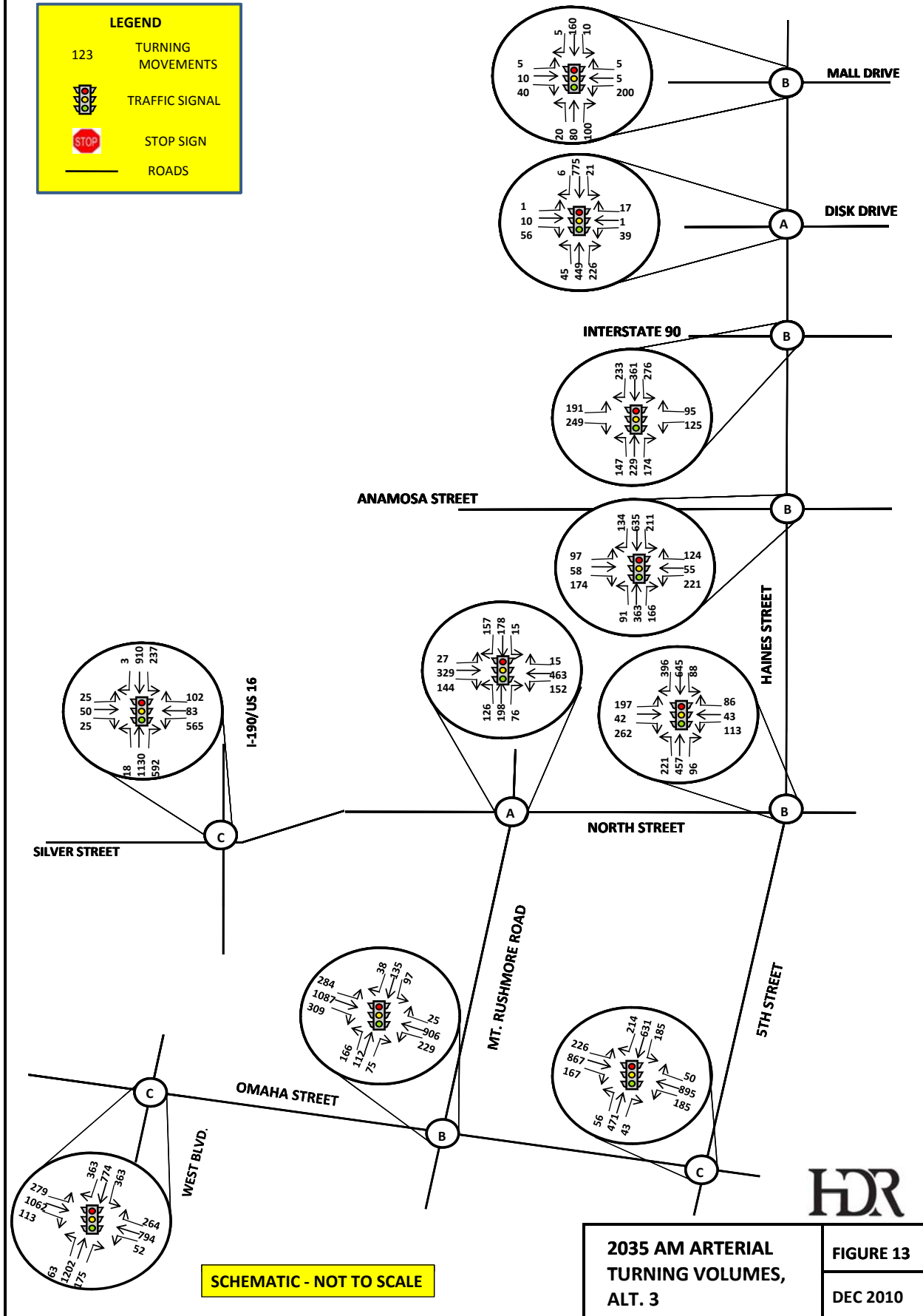
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123      TURNING MOVEMENTS

      TRAFFIC SIGNAL


      STOP SIGN


—      ROADS



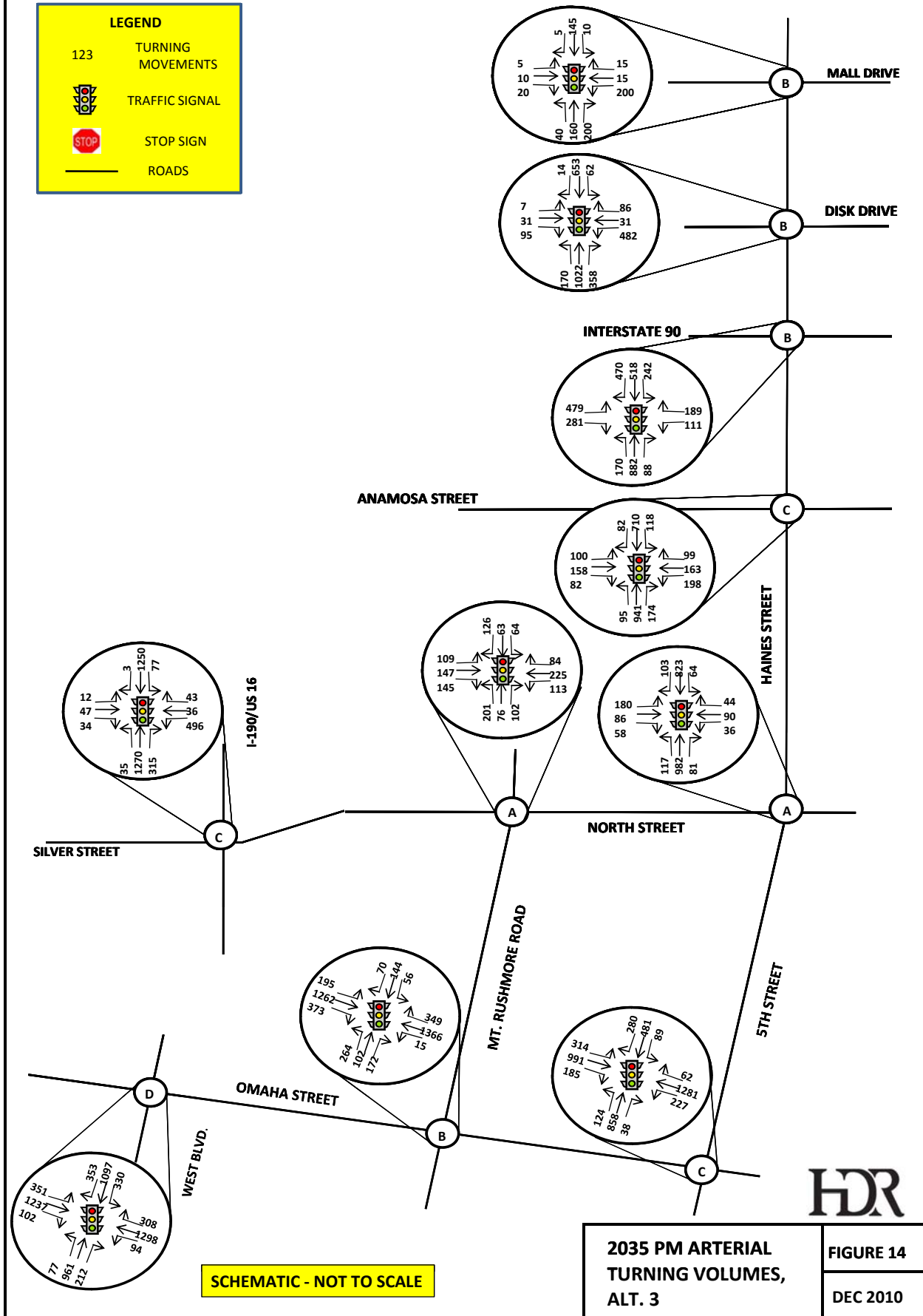
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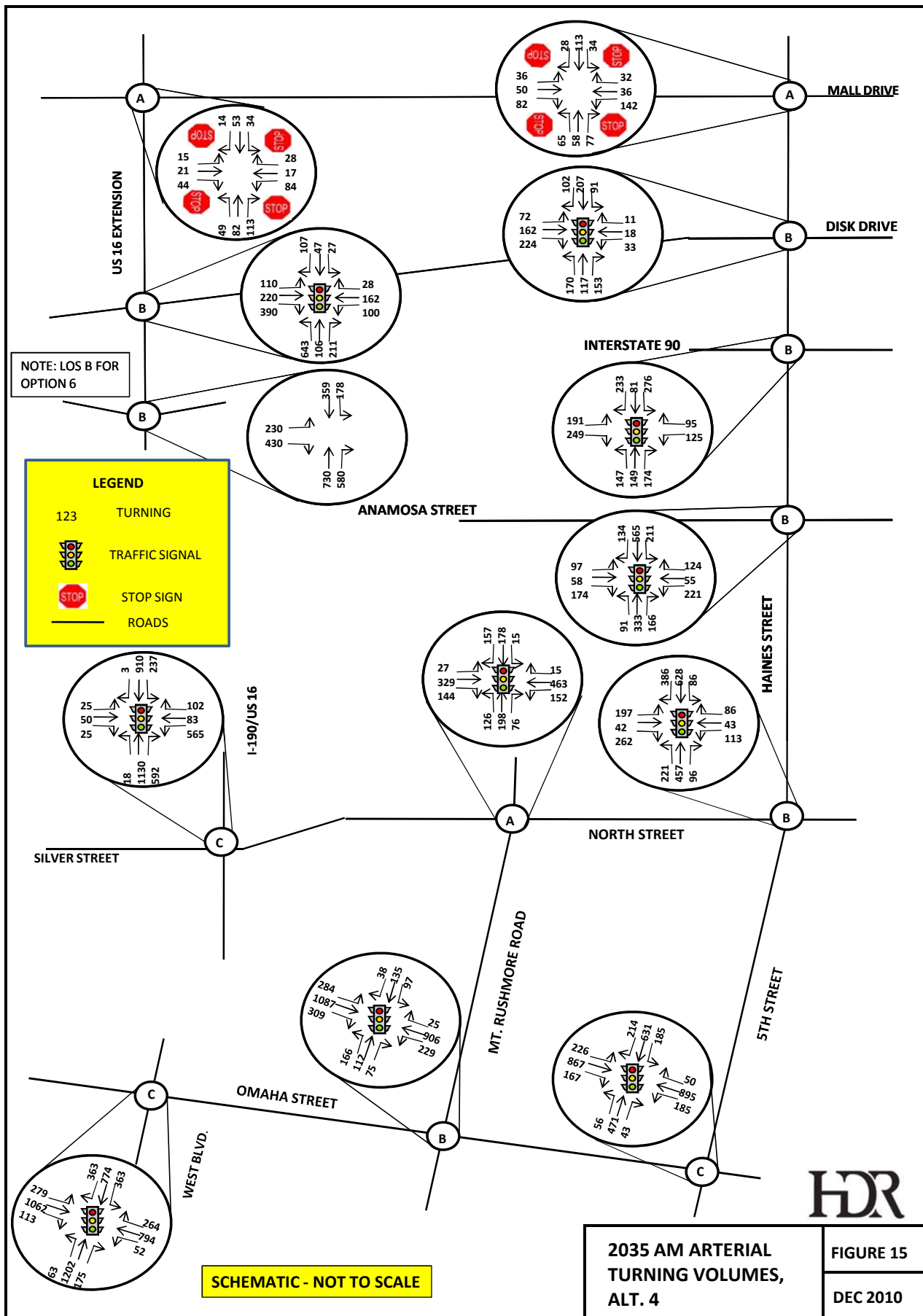
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      TRAFFIC SIGNAL

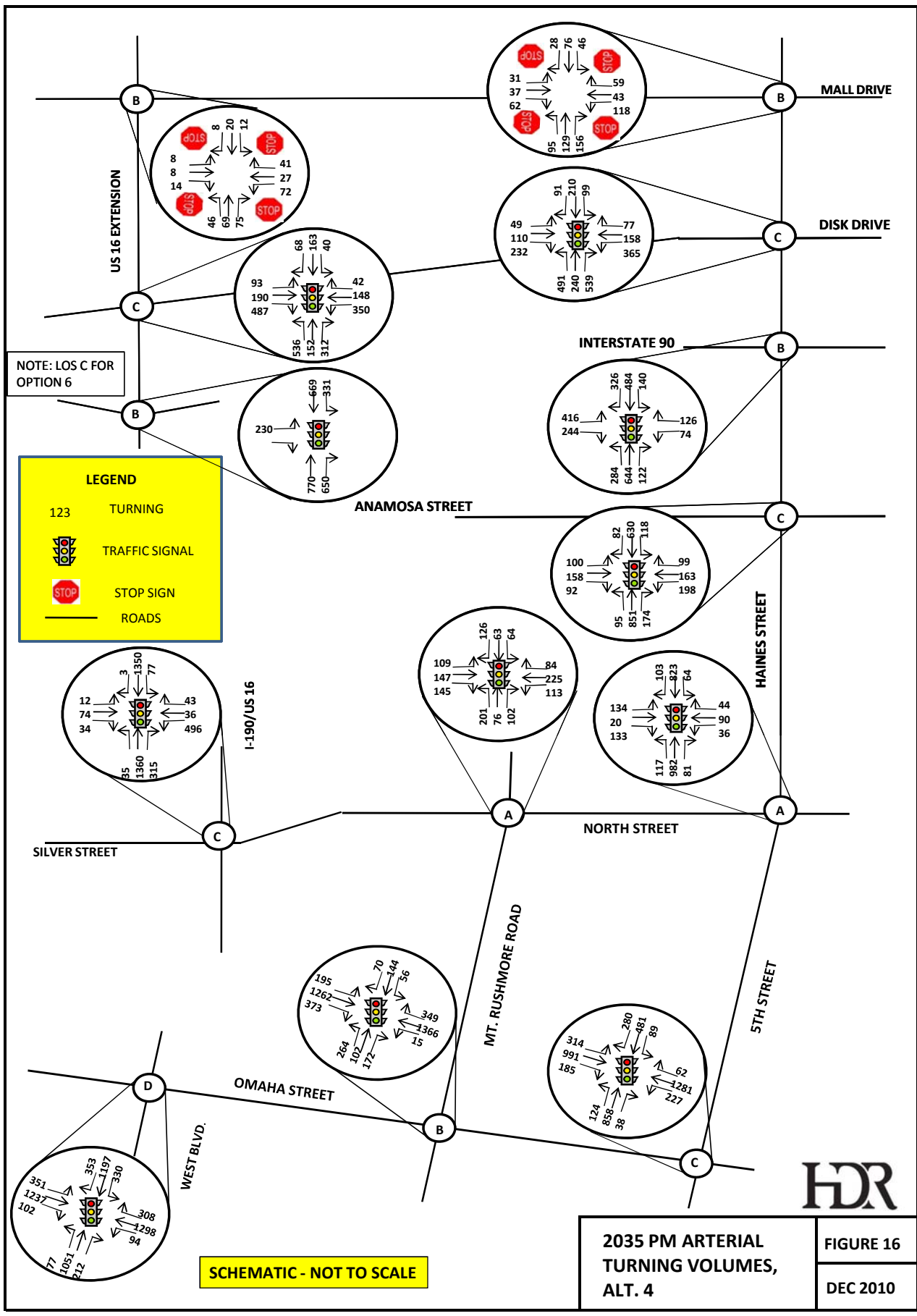
      STOP SIGN

—      ROADS









**DISK DRIVE CONNECTION FEASIBLY PREFERRED OPTION #1  
MALL DRIVE CONNECTION THROUGH OLDFIELD STREET HOMES**

NO.	ITEM DESCRIPTION	APPROX QTY	UNIT	UNIT BID PRICE	EXTENDED PRICE
<b>Roadway</b>					
1	Mobilization	1	LS	\$ 200,000.00	\$ 200,000.00
2	Construction Staking	1	LS	\$ 40,000.00	\$ 40,000.00
3	Clearing	1	LS	\$ 35,000.00	\$ 35,000.00
4	Remove Concrete Curb & Gutter	2,000	LF	\$ 5.00	\$ 10,000.00
5	Remove Barrier Wall	1,410	FT	\$ 4.00	\$ 5,600.00
6	Remove Concrete Pavement	21,077	SY	\$ 4.00	\$ 84,300.00
7	Remove Luminaire Pole	2	EA	\$ 150.00	\$ 300.00
8	Unclassified Excavation	50,000	CY	\$ 2.50	\$ 125,000.00
9	Remove & Place Topsoil	3,700	CY	\$ 2.50	\$ 9,300.00
10	Incidental Work, Grading	1	LS	\$ 20,000.00	\$ 20,000.00
11	Base Course	9,600	TON	\$ 13.00	\$ 124,800.00
12	Asphalt Concrete Composite	980	TON	\$ 90.00	\$ 88,200.00
13	10.5" Nonreinforced PCC Pavement	23,107	SY	\$ 35.00	\$ 808,700.00
14	6" Median PCC Pavement	1,624	SY	\$ 26.00	\$ 42,200.00
15	Storm Sewer Modifications	1	LS	\$ 150,000.00	\$ 150,000.00
16	Watermain Modifications	1	LS	\$ 20,000.00	\$ 20,000.00
17	Sanitary Sewer Modifications	1	LS	\$ 20,000.00	\$ 20,000.00
18	Pavement Marking	8,450	LF	\$ 0.60	\$ 5,100.00
19	Traffic Control / Detours	1	LS	\$ 40,000.00	\$ 40,000.00
20	Type B610.5 Concrete Curb and Gutter	11,146	LF	\$ 16.00	\$ 178,300.00
21	Seeding, Fertilizing, Mulching	1	LS	\$ 15,000.00	\$ 15,000.00
22	Erosion Control	1	LS	\$ 34,000.00	\$ 34,000.00
23	Landscaping Restoration	1	LS	\$ 20,000.00	\$ 20,000.00
24	Roadway Lighting	1	LS	\$ 60,000.00	\$ 60,000.00
25	Signal System	1	EA	\$ 80,000.00	\$ 80,000.00
Subtotal:					\$ 2,215,800.00
Contingency (20%)					\$ 443,160.00
<b>Roadway Subtotal:</b>					<b>\$ 2,659,000.00</b>

NO.	ITEM DESCRIPTION	APPROX QTY	UNIT	UNIT BID PRICE	EXTENDED PRICE
<b>Bridge Structure and Walls</b>					
26	Incidental Work, Structure	1	LS	\$ 25,000.00	\$ 25,000.00
27	Structure Widening (6' Sidewalk & 10' Shared Use Path)	5,760	SQFT	\$ 110.00	\$ 633,600.00
Subtotal:					\$ 658,600.00
Contingency (20%)					\$ 131,720.00
Structure & Wall Subtotal:					\$ 790,000.00

**Construction Total: \$ 3,449,000.00**

NO.	ITEM DESCRIPTION	APPROX QTY	UNIT	UNIT BID PRICE	EXTENDED PRICE
<b>Right-of-Way And Utilities</b>					
28	Right-of-Way Impacts* (Including Trailer Court)	172,000	SQFT	\$ 20.00	\$ 3,440,000.00
29	Purchase Mobile Homes	15	EACH	\$ 25,000.00	\$ 375,000.00
30	Tenant/Owner Relocation Costs	15	EACH	\$ 10,000.00	\$ 150,000.00
31	Private Utility Relocations	1	LS	\$ 30,000.00	\$ 30,000.00
ROW Subtotal:					\$ 3,995,000.00

\* Includes Damages to Remaining Trailer Park

**Grand Total: \$ 7,444,000.00**

**DISK DRIVE CONNECTION FEASIBLY PREFERRED OPTION #2**  
**MALL DRIVE CONNECTION THROUGH OLDFIELD STREET HOMES W/ EB ON RAMP LOOP**

NO.	ITEM DESCRIPTION	APPROX QTY	UNIT	UNIT BID PRICE	EXTENDED PRICE
<b>Roadway</b>					
1	Mobilization	1	LS	\$ 200,000.00	\$ 200,000.00
2	Construction Staking	1	LS	\$ 40,000.00	\$ 40,000.00
3	Clearing	1	LS	\$ 35,000.00	\$ 35,000.00
4	Remove Concrete Curb & Gutter	2,000	LF	\$ 5.00	\$ 10,000.00
5	Remove Barrier Wall	1,785	FT	\$ 4.00	\$ 7,100.00
6	Remove Concrete Pavement	28,050	SY	\$ 4.00	\$ 112,200.00
7	Remove Luminaire Pole	2	EA	\$ 150.00	\$ 300.00
8	Unclassified Excavation	60,000	CY	\$ 2.50	\$ 150,000.00
9	Remove & Place Topsoil	4,500	CY	\$ 2.50	\$ 11,300.00
10	Incidental Work, Grading	1	LS	\$ 20,000.00	\$ 20,000.00
11	Base Course	12,000	TON	\$ 13.00	\$ 156,000.00
12	Asphalt Concrete Composite	2,010	TON	\$ 90.00	\$ 180,900.00
13	10.5" Nonreinforced PCC Pavement	26,414	SY	\$ 35.00	\$ 924,500.00
14	6" Median PCC Pavement	2,224	SY	\$ 26.00	\$ 57,800.00
15	Storm Sewer Modifications	1	LS	\$ 150,000.00	\$ 150,000.00
16	Watermain Modifications	1	LS	\$ 20,000.00	\$ 20,000.00
17	Sanitary Sewer Modifications	1	LS	\$ 20,000.00	\$ 20,000.00
18	Pavement Marking	8,500	LF	\$ 0.60	\$ 5,100.00
19	Traffic Control / Detours	1	LS	\$ 40,000.00	\$ 40,000.00
20	Type B610.5 Concrete Curb and Gutter	12,606	LF	\$ 16.00	\$ 201,700.00
21	Seeding, Fertilizing, Mulching	1	LS	\$ 15,000.00	\$ 15,000.00
22	Erosion Control	1	LS	\$ 34,000.00	\$ 34,000.00
23	Landscaping Restoration	1	LS	\$ 20,000.00	\$ 20,000.00
24	Roadway Lighting	1	LS	\$ 60,000.00	\$ 60,000.00
25	Signal System	2	EA	\$ 80,000.00	\$ 160,000.00
Subtotal:					\$ 2,630,900.00
Contingency (20%)					\$ 526,180.00
<b>Roadway Subtotal:</b>					<b>\$ 3,157,000.00</b>

NO.	ITEM DESCRIPTION	APPROX QTY	UNIT	UNIT BID PRICE	EXTENDED PRICE
<b>Bridge Structure and Walls</b>					
26	Incidental Work, Structure	1	LS	\$ 25,000.00	\$ 25,000.00
27	Structure Widening (6' Sidewalk & 10' Shared Use Path)	5,760	SQFT	\$ 110.00	\$ 633,600.00
Subtotal:					\$ 658,600.00
Contingency (20%)					\$ 131,720.00
Structure & Wall Subtotal:					\$ 790,000.00

**Construction Total: \$ 3,947,000.00**

NO.	ITEM DESCRIPTION	APPROX QTY	UNIT	UNIT BID PRICE	EXTENDED PRICE
<b>Right-of-Way And Utilities</b>					
28	Right-of-Way Impacts* (Including Trailer Court)	202,000	SQFT	\$ 20.00	\$ 4,040,000.00
29	Purchase Mobile Homes	15	EACH	\$ 25,000.00	\$ 375,000.00
30	Tenant/Owner Relocation Costs	15	EACH	\$ 10,000.00	\$ 150,000.00
31	Building Impacts	1	EACH	\$ 150,000.00	\$ 150,000.00
32	Private Utility Relocations	1	LS	\$ 30,000.00	\$ 30,000.00
ROW Subtotal:					\$ 4,745,000.00

\* Includes Damages to Remaining Trailer Park

**Grand Total: \$ 8,692,000.00**

